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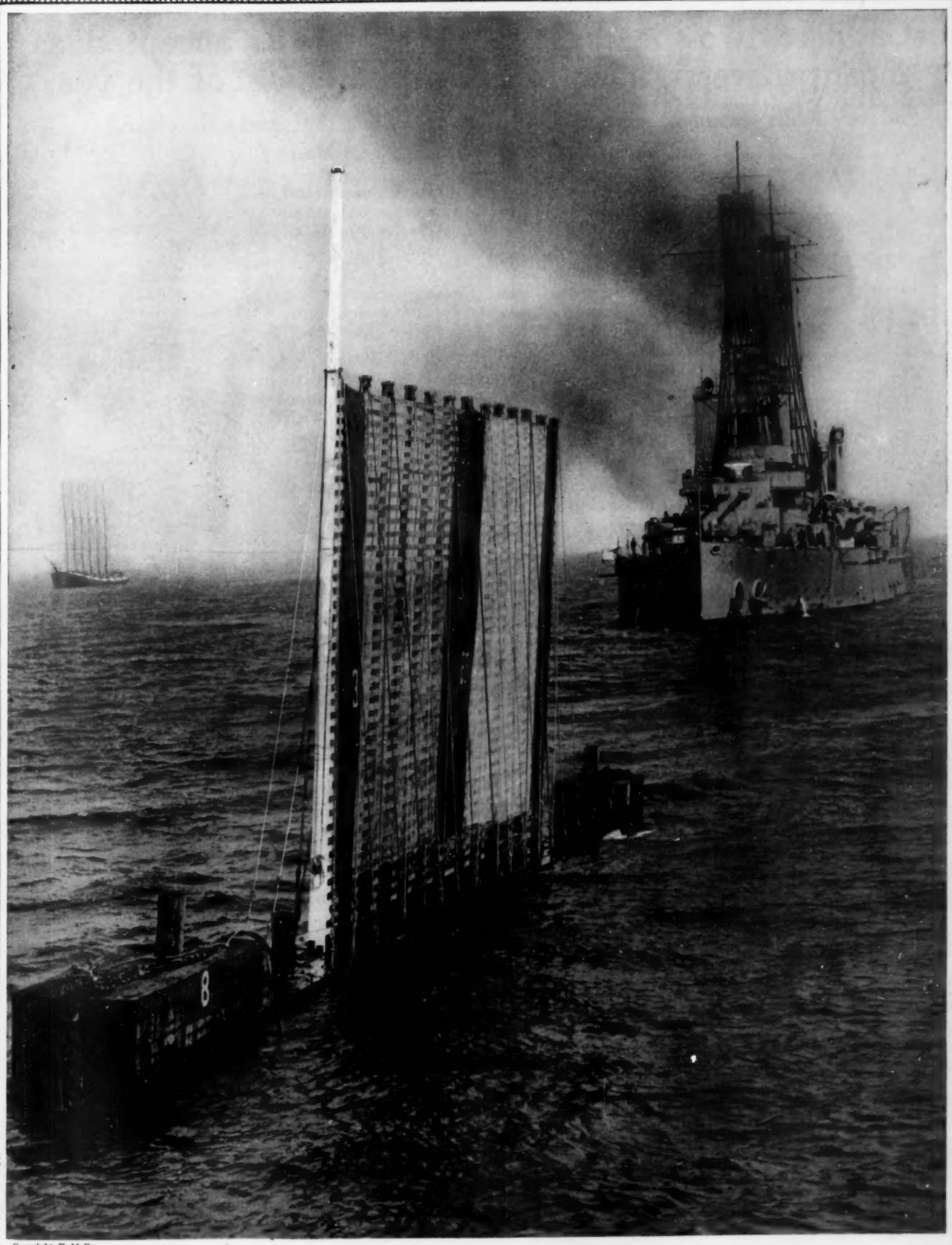

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A MODERN BATTLE-PRACTISE TARGET

Vol. CX. No. 3
January 17, 1914

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New York, N. Y.

Price 10 Cents
$3.00 A Year

BOYS' READING CLUBS

BOYS' READING CLUBS

Cadillac

Standard of the World

The Cadillac two-speed direct drive axle is accepted as the most progressive motor car development of the year

Press comment abroad and at home makes that perfectly clear

It presages the trend of motor car engineering

It is the all-absorbing topic in American and European trade and engineering circles, and the second award of the Dewar Trophy to the Cadillac has accentuated the intense interest.

And these native and foreign engineers and editors are merely saying in technical terms what the first Cadillac owner you meet will tell you in much simpler language.

The owner of a new Cadillac—and more than 7500 of the new cars are now in operation—will tell you in blunt, plain English, that he has never ridden in a car which compared with it.

He may not argue the merits of the two-speed direct drive principle.

He will simply say:

"Get in and ride with me and you will agree that you never experienced a sensation so much like floating through space."

And if you do ride you will agree with him.

There have always been Cadillac owners, thousands of them, who would not concede for a moment that more money could buy a better car.

But there are thousands who go much further now.

They will not admit that any car is comparable in its riding qualities to this new Cadillac.

And there are other things as well which they will not admit.

Above all, they will not admit that there is a car which is comparable in those dominant characteristics which earned for the Cadillac the second award of the honor most sought by European makers—the Dewar Trophy.

That award stamped the Cadillac as possessing in the highest degree, those qualities which make most for all around practicability, for day-in-and-day-out and year-in-and-year-out constancy, satisfaction and service in the hands of the every-day user.

From "The Autocar" (London)

WHEN the Cadillac system of combining ignition, lighting, and engine starting in one electrical system was introduced two years ago, it was very properly regarded as a bold step, and it was certainly the most interesting innovation which had been made for a long time, while experience has shown it to be as successful as it was bold. To-day the Cadillac designers have made another innovation, which, personally, we regard as even a greater improvement than the very important one of two years ago.

After once experiencing the delight of two direct and noiseless drives one feels that it is difficult to outline an ideal car which does not contain this feature, and we feel fairly safe in asserting that the Cadillac successful reintroduction of an old idea will be followed by other makers.

From "The Motor" (London)

WE have always held the Cadillac in the highest esteem, and admired it as a criterional example of high-grade American construction. The charm of the dual drive to the rear axle is compelling and entrancing, and as one merely touches the little lever at the side and, on depressing and allowing the clutch to rise, finds a higher direct drive available, wonderment is aroused as to the undoubtedly simple manner in which so great an advantage has been brought about.

The luxury of driving a touring car at 20 or 25 miles an hour with a direct drive and final gear ratio of 2.5 to 1 is quite a new fascination.

From "Motor Age" (Chicago)

ADOPTION of the two-speed rear axle by one of the larger makers of motor cars for the coming season may be taken as a criterion of the efforts that are general throughout the industry toward easier maintenance. In this case, the ease of maintenance attained is indirect, but none the less present. The effect of doubling the number of speeds obtained in the gearset is believed to make for longer life of the motor since it need not be worked on a hard pull or made to turn over so rapidly at high car speeds. In other words, the increased flexibility of the power plant is expected to result in its greater useful life.

From "Horseless Age" (N.Y.)

IT seems at least possible that the two-speed axle may confer upon the four-cylinder car sufficient flexibility and accelerative ability, without recourse to noisy geared speeds, to satisfy the public demand for these qualities, and, if this should prove to be the case, the demand for six-cylinder cars, with their somewhat more costly, more bulky, more complicated and less economical motors, might be materially reduced. It can hardly be doubted that the advent of the double-direct drive is one of the most important happenings of recent years in the automobile industry.

From "The Automobile" (N.Y.)

In these days of innovations and quick transitions it is questionable if the two-speed axle, now that it has been announced by the Cadillac company, will not be taken up with avidity; true it will not come with a landslide like the self-starter, but in the form of a sure and certain movement.

Cadillac Motor Car Co. Detroit, Mich.

SEVENTIETH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CX
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NEW YORK, JANUARY 17, 1914

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Dredging Out the Culebra Slide

IN bygone ages that strip of land ten miles wide by forty long, which is now known as the Canal Zone, was under water. Its upper layers or strata were formed by a slow deposit of solid materials, which, in the course of ages, settled to the bottom and became more or less compacted. Ultimately, volcanic action raised this portion of the floor of the ocean above the level of the sea and formed the Isthmus of Panama. The bed of the ocean as thus elevated was lifted irregularly and in considerable confusion. Here and there, the molten igneous rock was forced up through the overlying marine deposit, destroying the general level and producing that confused topographical appearance with which every visitor to the Isthmus is familiar. When these volcanic agencies quieted down many centuries ago, the dry land, as thus formed, consisted of ridges of hard igneous rock, between which, broken up into great confusion, lay the above mentioned masses of submarine deposits, in various stages of hardness, but possessing very little resistance to crushing or sliding or other movements, should the conditions of equilibrium into which it had settled be once disturbed.

Then came the engineer with his drilling machines, dynamite, steam shovels and dredges, and proceeded to cut a deep and broad pathway through this geologically confused mass of material. Where he encountered the volcanic rock, that material stood up to the arbitrary slope which the engineer had determined upon for the sides of his great excavation; but when he cut into the looser marine deposited material, he began to get into trouble. Nature took the matter in hand, laughed at the engineer's contours and slope stakes, and proceeded to grade the sides of the cuttings according to her own liking. Generally speaking, she preferred a slope of one to seven, as against the engineer's slope of one to two. As a matter of fact, nature has been a very active agent in the excavation of the Panama Canal; for between thirty and forty million cubic yards must be credited to her activity as against one hundred and ninety million cubic yards done by the engineers of Uncle Sam, or, say, something over one sixth of the whole.

Very early in the work did nature begin to have her say in the matter of digging a canal at Panama. In fact, over thirty years ago, when the French commenced excavation at the deepest point of the canal, the Cucuracha slide caused the French engineers many an hour of anxious thought, and as the Cucuracha slide was the first, so to-day it is the last problem to be solved.

The accompanying illustration shows the dredges at work on this slide. The deepest excavation at Culebra occurred where one of those great masses of igneous rock forced their way through to the surface. Immediceately to the south of it, and on the east side of the canal, is a large pocket of soft material which, with rare intervals of repose, has been steadily slipping down into the canal prism, as the work of excavation went down and the toe of the slope was cut away. So long as the steam shovels were at work, it was possible to shovel the material out about as fast as it came. When the tracks were taken up and the shovels removed, previous to blowing up the Gamboa dike, there was an interval in which the slide had, perforce, to be left to its own devices, and it moved into the cut until the prism was filled up approximately to the full depth of 45 feet.

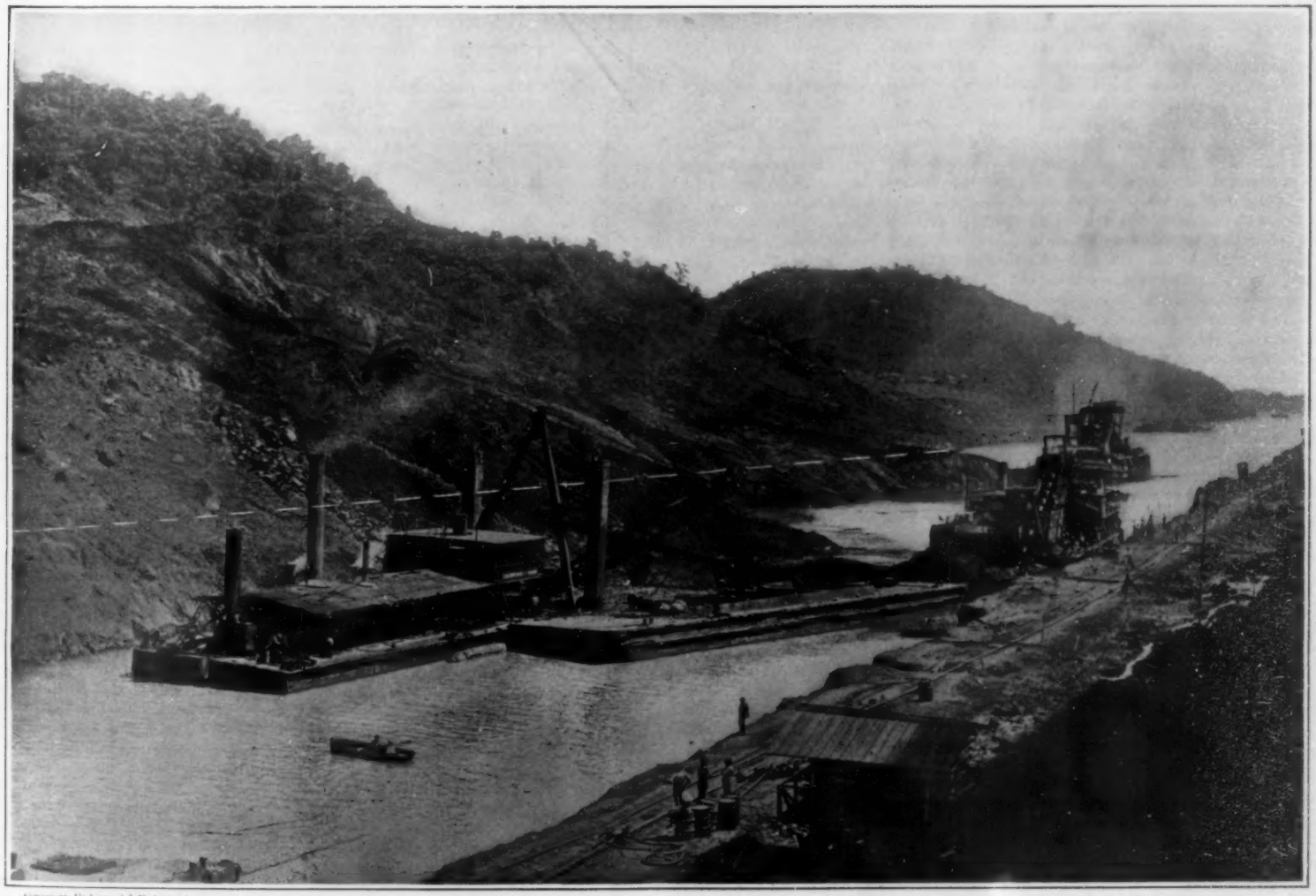
For several weeks past a whole fleet of dredges has been attacking the slide, and, according to the last dispatches, the channel through the base of it has been widened to a width of about 150 feet and a depth of 16 feet. The dotted line in our illustration shows approximately where the eastern bank of the canal should be. All the material on that side to the west of this will have to be taken out. The excavating plant, according to the latest dispatches, consists of three dipper dredges and two ladder dredges. Two 15-yard dredges, now nearing completion, will soon be at work, and they will make short work of the slide—probably.

A New Source of Paper Pulp

THE alarming dearth of raw material for paper making has stimulated research in this direction for several years. *La Revue* gives an account of the successful efforts now being made to produce excellent paper pulp from the *Hedychium coronarium*, a fibrous plant of the ginger family, having its origin in India, but growing in tropical parts of Asia, Africa, and America. The members of this family have fibrous stalks of various heights ranging up to 2 feet 6 inches or more, and covered with leaves.

From the dry fiber a very good pulp is obtained, one hectare of land yielding 14 tons of fiber, which produces about 8 tons of pulp. The cultivation demanded is inexpensive, and there are two or three harvests a year.

The process of treatment is simple—the plant is cut, pressed between rollers to dry it, beaten, and then heated with a varying proportion of soda. It may be *broken* instead of beaten, but in this case the paper is less fine in quality, though on the other hand it is much tougher.



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Removing the Cucuracha slide. Dotted line shows how greatly slide has encroached on canal.

THE LAST BARRIER IN THE PANAMA CANAL

SCIENTIFIC AMERICAN

Founded 1845

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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Ships that Break in Two

OCCASIONALLY, but fortunately very, very rarely, ships have been known to break in two while they were being driven across the seas. Several years ago this thing happened to the fastest torpedo-boat destroyer in the world, the "Viper," which was credited with having made thirty-six knots over the mile course. It happened last week to a large tank steamer before it had traveled very many miles from Sandy Hook.

The breaking of a ship's back is a common occurrence in cases where they have run upon the beach, or fetched up on a shoal of sand or rock—but that is to be expected. In these cases the breaking apart generally results from a falling tide leaving the vessel supported only amidship or only at the ends. As the tide falls away from the vessel, and her weight becomes less and less water-borne, the longitudinal bending stresses increase, till a point is reached where the plating tears apart, generally along a zigzag line of plate riveting or along a vertical straight line of bulkhead connection.

But it is not necessary that a ship be on the beach, or hung upon a shoal, to run the risk of having her back broken. This catastrophe, as the disasters to the destroyer "Viper" and the tank-ship "Oklahoma" show, may happen on the high seas and in deep water. It occurs very rarely, largely for the reason that several contributory conditions must be present simultaneously before it will happen. In saying this, it will be understood, of course, that poor design may wreck any ship that sails the seas. If the naval architect fails to build his ship with sufficient depth in proportion to her length, or if she be shallow and he fails to put sufficient extra metal into her bottom and upper decks to give the proper girder strength, she is liable to break in two in her first encounter with heavy weather.

But we are not considering poorly-planned vessels. The destroyer "Viper" was designed by a prominent architect, and built in one of the leading yards of Great Britain; and the tank steamer "Oklahoma" was constructed in what is considered to be the finest shipbuilding yard in this country, and presumably she was well designed.

Just here, it may be well to state that the bending stresses tending to wreck a ship so far as wave action is concerned, come either when the ends of the ship are deeply immersed in two following waves, or when the body of the ship is deeply immersed, and the two ends are in the troughs of the sea. Under the first condition, the ship may be considered as, roughly speaking, a bridge supported on two end piers. Under the second condition, it may be considered as a drawbridge swung open and supported at its center. In the first case, the ship will tend to sag amidships, in the second, to sag at the ends.

Now these conditions will be aggravated when the distance from crest to crest of wave is approximately the same as the overall length of the ship, particularly if the seas are short or steep. The stresses tending to bend or break the ship can also be very seriously affected by the loading. Thus, a ship that is running light as to cargo, and is water-ballasted forward to offset the weight of engine and boiler and full coal bunkers at the after end of the ship, would be subjected to specially severe stress when she was supported at her mid-length during the passage of the crest of the sea.

How severe these bending stresses are may be judged from the fact that one of the earlier 23-knot ocean liners was proved by exact instrumental measurement, taken for the purpose while she was being driven hard into very heavy head seas, to have a vertical movement at the ends with regard to the midship section of twelve inches. Though this was excessive, it does not prove that the ship was structurally weak; for in such vessels the deep double bottom and the continuous steel upper decks, provide sufficient top and bottom chord material to permit the necessary extension and compression of the steel without exceeding the elastic limit.

In the tank steamer, however, the provision of sufficient girder strength is not so easy of accomplishment as it is in the case of an ocean liner with its plurality of upper steel decks. The tank steamer, and in fact all steamers of the Great Lakes type that are built to carry heavy freight in bulk, consist, throughout the greater part of their length, of a double bottom, the two sides and a single upper deck; this last being pierced by many hatches, some of them of very large size. Much ingenuity has been shown in the endeavor to make these long shallow ships sufficiently strong to carry their heavy load safely through heavy seas.

Great technical interest will attach to the investigation of the accident to the "Oklahoma." Say what we will, this accident must necessarily arouse a certain degree of distrust of present tank-steamer construction; and it is sincerely to be hoped that sufficient evidence will be gathered from the survivors to enable the naval architect to determine just where the rupture commenced, and exactly in what manner the ship's plating tore asunder. It is important to know whether the fracture followed a zigzag line along the side plating or whether, as Mr. Holmes has suggested, it followed a vertical line of rivet holes where a transverse bulkhead was attached to the hull.

The Kahn Act and Foreign Exhibitors of Patented Articles at the Panama-Pacific Exposition

NO remarkable prophetic gift was needed to foretell the storm of protest that has followed the approval of the Kahn bill—a measure which is intended to protect foreign exhibitors at the Panama-Pacific Exposition from patent and copyright infringement by Americans, by enabling a foreigner who has patented his product in his home country to obtain absolute protection in this country by the mere filing of the necessary papers, without any search as to novelty and without complying with any of the rigorous requirements of the American patent law. The bill was so clearly unconstitutional that few thought it possible that it would ever pass. And yet the impossible has happened.

The defects of the measure are so apparent that as it stands it cannot endure the legal scrutiny of the United States Supreme Court. It may be doubted whether Mr. Bulkley's painstaking revision will help matters much, although it seeks to remedy the more crying evil of the original by providing that the exhibits shall not enjoy the protection so generously accorded by the Kahn act if they have been "in public use or on sale in this country" or shall have "become the property of another under the laws of this country." While this may remove the absurdity of preventing an American manufacturer from producing an article unpatentable in this country, but patentable in some European countries, it throws upon the foreign exhibitor the burden of proving that his product is indeed patentable in this country and that an American defendant is an out and out infringer. In other words, the foreign exhibitor might just as well apply for a United States patent in the regular way if he is to enjoy any benefits from the Kahn act as Mr. Bulkley seeks to amend it.

It is difficult to understand why the exposition authorities should have been so deeply concerned in the protection of foreign exhibitors. We are not aware that any foreign country has ever extended to exhibitors of other nations at any exposition the rights and privileges extended by the Kahn Act. Furthermore, a foreign manufacturer who exhibits at San Francisco no doubt does so for commercial reasons. If he hopes to interest Americans in his product by availing himself of the opportunities accorded him at San Francisco, there seems to be no valid reason why he should not protect himself in the manner prescribed by the constitution and the patent laws of this country.

As they now stand, our patent laws are probably the most generous of their kind in the world. From the very first the United States of America set an example to the world in freely according to foreigners the same measure of protection for patentable inventions as to Americans. If there were any possible discrimination against foreigners, there might be some excuse for the Kahn Act; but as matters now stand, the Act places the foreign manufacturer of an invention which he has patented in his own country, but which for good reasons is unpatentable in this country, in a far better position than his American rival.

Nothing short of the absolute repeal of the Kahn Act can be justly demanded. Not only is it unfair to Americans, but it deals unfairly even by the foreigners whom it is supposed to protect. Of the unconstitutionality of the Act as it now stands there can be no question. Yet the exposition authorities are apparently lulling foreigners into the belief that they may safely exhibit inventions in San Francisco, which in the eyes of the Patent Office and of our courts would be public property. What will be their astonishment when they seek to apply the Kahn Act to their special cases and find themselves thrown out of court? Will we not be accused of double dealing? The governments of Europe have not all unanimously decided to participate in making the Panama-Pacific Exposition a success. A general feeling is rife that there have been too many expositions. If the Kahn Act ever comes up for judicial construction and is declared unconstitutional and void, it may be doubted if foreign governments will look with favor upon future American expositions.

The Sun-power Plant in Egypt

A RECENTLY prepared report on the sun-power plant at Meadi, Cairo, gives some important data on this highly interesting development.

A series of trials was carried out under favorable weather conditions, in which, we are told, the area of sunshine collected and utilized in heating the five boilers was 13,269 square feet, and the maximum steam pressure generated was 1.1 pound per square inch above atmosphere, the minimum pressure 1.0 pound per square inch.

The average amount of steam generated per hour throughout the trials was 1,169 pounds. The maximum amount of steam generated during any one hour was obtained between 1:10 and 2:10 P. M. on August 22nd and amounted to 1,442 pounds, while the minimum generated in any one hour was obtained between 3:15 and 4:15 P. M. on August 25th, and amounted to 886 pounds.

In order to obtain the best results from steam at the low pressure of the sun-power system, it should be utilized in a suitable steam engine. A condensing engine especially designed for use in connection with the sun-power boilers was tested in 1912, and when it was developing 97½ brake horse-power the steam required at a pressure of 1 pound per square inch above atmosphere was only 22 pounds per brake horse power.

Had the installation at Meadi consisted of nine sun boilers instead of five they would have produced enough steam to have kept this engine running and developing an average of over 95 brake horse-power throughout the twelve and a quarter hours occupied by the trials.

What progress has been made during the last two years can be seen by comparing the results here quoted with those obtained at the Tacony (Philadelphia) plant in 1911:

The total area of sunshine collected by that plant was 10,296 square feet. The average amount of steam produced throughout a 4-hour trial on August 10th was 693 pounds per hour. The mean steam pressure during the four hours was 1.2 pound per square inch *below* atmospheric pressure.

The most important figure, however, and one which is closely comparable, is the steam produced per hour per square foot of sunshine collected. The maximum for the Tacony boiler was 0.090 pound per square foot per hour, whereas the corresponding figure for the Meadi boiler was 0.12 pound per square foot per hour, which is equivalent to an increase of 33 1/3 per cent, a very gratifying improvement, especially when it is borne in mind that the mean steam pressure at Tacony was 2 pounds per square inch less than at Meadi.

That this improvement is not entirely due to the generally better climatic conditions of Meadi as compared with those of Tacony seems to be indicated by the fact that the Tacony result was obtained when the mean temperature in the shade was 90.4 deg. Fahr. and the mean humidity 45.5 per cent, while the Meadi result was obtained when the shade temperature was 95.5 deg. Fahr. and the humidity 35 per cent. Hence a considerable portion of the 33 1/3 per cent increase of output may fairly be attributed to improvements in the design of the plant.

These results seem very encouraging, and we may express the hope that this pioneer undertaking may meet with the success that it deserves.

A Radio Manual will shortly be issued by the United States Signal Corps, dealing with the installation and operation of radiotelegraphic apparatus, especially field stations, and intended primarily for the guidance of the regular and militia forces. After much experimenting the Signal Corps has devised field radio outfits that will probably not be materially modified for some years to come. A radio pack set, which is carried by 8 mules, can be put in operation in two minutes, weighs 370 pounds, and under service conditions has a range of 25 miles. A wagon set of 2 kilowatts power has a range of more than 200 miles. It is made up of a pintle-type wagon, drawn by four animals, the rear cart containing the power plant and the front the operating apparatus.

Electricity

Wireless on the Great Lakes.—According to the Department of Commerce, the disastrous storm of last November on the Great Lakes furnished a signal illustration of the necessity of equipping lake vessels with wireless telegraphy. All vessels so equipped received warning of the storm and sought shelter, while 19 American vessels without wireless were lost. About 50 vessels are now preparing to add wireless telegraph apparatus to their equipment.

Large Plant for Producing Carbide and Nitrate of Calcium.—An electro-chemical works which ranks among the large Swedish plants of its type, has been installed near Johannesburg, and it is designed to turn out carbide and nitrate of calcium upon a new process invented by Engineer F. Carlson. It is stated that there are now running on this principle, four 400-kilowatt furnaces using single-phase current, for the production of carbide. As to nitrate of calcium, which is employed for fertilizing purposes, there are in use six furnaces on the 3-phase system of 2,600 kilowatt size. In order to secure what current the present plant demands, a large hydraulic plant is erected at a cost of over a million, and it operates by power from the Ljungan stream.

Largest Electric Hoist in America.—One of the largest electric hoists in the world, and exceeded only by a few in South Africa, will be installed in the Granite Mountain shaft of the North Butte Mining Company. The hoist will have a capacity of 300 tons per hour hoisted from a 2,000-foot level, or 200 tons per hour from a 4,000-foot level. The shaft is now approaching the 2,900-foot level. The hoisting drum, 12 feet in diameter, will be driven by a direct-connected electric motor supplied with power from a motor generator set provided with a 50-ton flywheel. The flywheel will give up some of its stored energy to supply the peak load drawn by the hoisting motor. The induction motor of the generator set will have a continuous rating of 1,400 horse-power and the hoisting motor will have a maximum intermittent rating of 4,500 horse-power.

Turbine Progress in Europe.—We note that the Brown-Boveri works is engaged in constructing a turbine group of no less than 40,000 horse-power size, it being intended for the Mark electric station in Westphalia. The alternator of this group is designed for 10,000 volts three-phase and 50 cycles and operated at 1,000 revolutions per minute. The turbine works on superheated steam at 350 deg. Cent. and 13.5 atmospheres pressure at the inlet, the entire group measuring about 33 feet long. Among other large turbines of this type we may mention the 30,000 horse-power alternator lately set up in the Reisholz plant near Düsseldorf, and a similar group is now building at the same works for an electric plant near Cologne. It is expected that steam turbines of as high as 50,000 or 60,000 horse-power will be constructed as the next move.

Electrolytic Extraction of Copper in Chile.—German electrical apparatus is now installed in a plant located in Chile for extraction of copper from the ore, and the works are said to be operating quite successfully at present. It makes use of the new Siemens-Schuckert electrolytic process. The electric station is situated at Cobija on the coast and 180 miles from the copper mines, which are inland, and the current is sent to the copper extraction plant at the mines by a power line. The electric station is steam operated, and is equipped with 16 boilers which are fired by oil fuel. Four steam turbines are each coupled to an alternator of 15,000 horse-power size which delivers 5,000 volts, and step-up transformers raise the voltage to 110,000 volts for operating the power line. At the copper mines is a substation containing motor-generator sets of 3,000 horse-power size which receive the current from the line and convert it to 250 — 190 volt current for use in the electrolytic tanks.

Electrifying Railways in Norway.—In Norway the government proposes to carry out quite an extensive scheme for applying electric traction to the railroads. According to an official report as to hydraulic resources, the state already owns enough water power to serve for nearly all the railroads in the south and west of the country. However, as it is intended to go into the matter on as large a scale as possible, the government is seeking to purchase as many falls as possible in order to obtain the needed amount of power. A great outlay of capital will be needed to carry out the extensive railroad project. Among the principal railroads are seven lines, including two from Christiania to the Swedish frontier, and others from that city to Gjoevik and Drammen. For the high-tension power lines from the turbine stations to railroads, including also the substations, the outlay is $12,000,000. Notwithstanding the considerable cost of adopting electricity for the railroads, it is expected to secure much economy in operating these lines. Parliament lately decided to begin the first work on the Christiania-Drammen railroad line. Norway is so rich in hydraulic resources that there is little excuse for the employment of any other power.

Science

An Institute for Bibliographic Research, the first of its kind in America, will soon be established in Chicago, if the plans of the Bibliographical Society of America are carried out.

A New Product of Seaweed, the invention of which is announced from Liverpool, is called "algin," and is used in the manufacture of non-inflammable cinematograph films and in the treatment of paper to make the latter water, flame and germ proof. Algin is said to be odorless.

An Institute of Oceanography, with a fine aquarium, is to be established at Ste. Adresse, a suburb of Havre, in a large park overlooking the bay of the Seine. It is hoped to have the institute open in time for the scientific congress to be held at Havre in the autumn of 1914. A feature of the institute's work will be practical instruction to fishermen.

Urotropine as a Preservative of Caviar.—A consular report states that of about 1,400,000 pounds of caviar obtained each year by the Astrakhan fisheries, approximately 75 per cent is exported, and the only preservative thus far found to keep the caviar fresh is urotropine, which is added in the proportion of 1 to 1,300, and is claimed not to be injurious to health.

The Discovery of Minor Planets still goes on apace. During the year ended June 30th, 1913, 67 of these bodies were given provisional numbers, though 5 of these subsequently proved to be old members of the asteroid family. Of the remainder, 19 were discovered at Heidelberg, 7 at Johannesburg, 9 at Neuchâtel, 11 at Simeis, 3 at Vienna, and 13 at Winchester. All minor planets from No. 1 to No. 727 have now been named.

A Plague of Wild Horses.—The Canadian government has been urged to take measures for checking the depredations of wild horses in the Peace River country in western Alberta and eastern British Columbia. The horses have been making raids on the ranches, killing many domestic horses and leading away valuable mares which had been imported at considerable expense by the settlers. The culprits are said to be the descendants of horses abandoned during the gold rush to the Yukon territory in 1897-98.

Soda Deposits of Lake Magadi.—The American consul at Zanzibar reports that Lake Magadi (spelled "Maggadi" on British official maps), lying southwest of Nairobi, in the southern part of British East Africa, is an almost inexhaustible source of soda. As the deposits are removed they are replaced through soda springs from which crystals of soda are constantly forming. A 95-mile railway has recently been built to connect this lake with the Uganda Railway, and a factory for preparing the soda is to be built at the lake. It is estimated that 160,000 tons of the worked product will pass over the railway to the sea. The soda deposits cover 30 square miles.

Lake Erie Outlet.—The International Waterways Commission has published its final report on the proposal to establish a submerged dam or weir at the outlet of Lake Erie for the purpose of raising the water in all the Great Lakes except Ontario. Its cost would be about $3,000,000, and the Commission unanimously recommends that a treaty be entered into between Great Britain and the United States providing for its construction. The report states that the level of the lakes has been appreciably lowered by the Chicago Drainage Canal and the Erie Canal. To illustrate the importance of this question, it is pointed out that the freight boats on the lakes are built to the greatest capacity the depth of harbors and channels will permit, and that every added inch of water means an increased capacity of 85 tons in these big vessels.

The Tsangpo-Brahmaputra Question Again.—The tantalizing question as to the nature of the connection between the Tsangpo River, of Tibet, and the Brahmaputra, of Assam, is not yet fully settled, despite the large number of explorers who have tried to clear up this celebrated mystery. It will be recalled that when a punitive expedition was sent by the British authorities against the savage Abors a couple of years ago, it was fully expected that the party would complete the exploration of the Dihong River, which undoubtedly forms the connecting link between the two great and well-known rivers (or, properly, parts of a common river), and that white men would then for the first time behold the immense falls supposed to exist where the river breaks through the mountains. Although the expeditionary force took along a scientific staff for the purpose of exploration, the geographical results of the mission were disappointing. During last summer British officers again explored in this region. One party reached a point on the river four days' journey below the supposed falls, while another penetrated to a point on the Tsangpo six days above the falls, but the falls themselves had not yet been reached when the last news was received in India. The barometric observations of the two parties seem to confirm the great difference of elevation implied by the existence of the falls and cataracts of Tibetan tradition.

Aeronautics

Beachey's Latest "Looping the Loop" Performance.—On December 25th Lincoln Beachey "looped the loop" five consecutive times from a height of 750 feet. Beachey turned a double loop at a height of only 300 feet.

A Monument to Capt. Scheimpflug.—On December 6th, 1913, a tablet was unveiled in Vienna to commemorate the achievements of the late Capt. Scheimpflug, who, as our readers will probably recall, was one of the first to interest himself in photography from aircraft. His photogrammetric camera-gun has been described in the SCIENTIFIC AMERICAN.

A New Army Altitude Reco —A new army altitude record was made at San Diego, on December 18th, by Lieut. H. B. Post, who ascended to a height of 10,600 feet, a gain of more than 2,000 feet over the previous record. The ascent was made in army carrying aeroplane No. 23 from North Island. Lieut. Post made the first 3,000 feet at an average rate of 540 feet a minute.

A French Mail Line by Air Across the Sahara.—The National Aerial League has completed plans for a flight of a flotilla of aeroplanes across the Sahara or Great Desert. They will start from Oran, Algeria, and the final landing will be made at Timbuktu, French Sudan, a distance of 1,400 miles. Pyramids of stones will be placed at intervals to mark the route. If the experiment proves successful the establishment of a regular air mail service will be considered.

Naval Aeronautics.—A definite programme for the development of aviation in the navy has been decided upon and will be put into operation at once. A naval aviation school will be established at Pensacola, the battleship "Mississippi" will be assigned to that station for use by the navy aviators, and during the winter practical experiments and training of naval officers in the operation of aeroplanes will be carried on. Flights will be made from the deck of the "Mississippi" and other experiments conducted in developing the use of the aeroplane in connection with battleships.

Vedrines' Flight from Paris to Cairo.—The flight of Vedrines from Paris to Constantinople in five stages and his supplementary journey to Cairo in three more stages must stand as one of the most remarkable achievements of that remarkable aviator. He defied the German authorities, who had refused him permission to fly over German territory (incidentally highly irritating German nerves by circling over a fortress) and braved the high winds of the Taurus Mountains, which proved the undoing of Daucourt. How far Vedrines will push on in his expressed intention of attempting the encircling of the globe remains to be seen. Invitations to fly to this or that point reach him almost daily.

A New Giant Biplane.—The Russian aviator and designer, Sikorski, whose huge aeroplane was described and illustrated in these columns last year, has now built a still larger machine, weighing no less than three tons and a half. It is said that the new machine is propelled by four motors of 100 horse-power each; but this is also the engine power of the old machine. The new biplane is said to have a carrying capacity of twenty people, and that cabins with sleeping accommodations are provided. On the trial trip the machine is said to have risen in the air after a run of 100 yards and to have circled the grounds without difficulty. The SCIENTIFIC AMERICAN hopes to publish a detailed account of the machine.

The Signal Corps Aviation School.—Teaching army officers the subjects of aero-mechanics and aeroplane design has something picturesque about it if we may judge from the account which one of the instructors gives us. When the clock strikes, the pupils flock from all corners of the sky and volplane down to the instructor's pulpit and blackboard in a great white tent. They sit erect and still as mice, smoking as they listen, while the dogs sleep at their feet. A beginning has been made in what may develop into regular and systematic annual courses of lectures accompanied by problems and experiments. The instructors thus far chosen are Dr. Alfred F. Zahn, Prof. Durand and Dr. Humphreys.

Marking Military Aircraft.—According to Major Bannerman-Phillips in the *United Service Magazine*, "it was announced some time ago that fresh orders would be issued shortly by the French Ministry of War regarding imposition of distinguishing marks on military aircraft." In future all military aeroplanes will bear on the under surface of each wing (the lower wing in the case of a biplane) a tricolor cockade one meter in diameter. Dirigible balloons, on the other hand, will bear on the under surface of the front of the balloon its name in large black letters. At the rear end of the balloon will be the national flag with a tricolor pennant immediately above and on the same halyards. The dimensions of the pennant are: height, half that of the flag; length, one and one half times the length of the flag. Free balloons owned by the military service are to have from one of the suspension cables the national flag, and on the opposite cable a tricolor pennant."

Gray lizard.
(*Lacerta muralis*) adult, full size.

Young lizard's fore foot.
(Magnified 20 diameters.)

Elbow of adult lizard.
The muscles represented.

Young lizard's fore leg.
(Magnified 20 diameters.)

X-Ray Photographs of Microscopic Objects

How They Are Made by the Goby Method

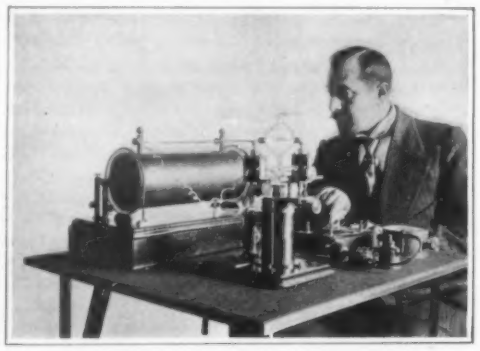
By the Paris Correspondent of the Scientific American

THE new apparatus made by the French scientist Pierre Goby opens up an attractive field of research which he calls micro-radiography, from the fact that it is now possible to obtain X-ray photographs of the internal structure of microscopic objects. As it appears that this is the first practical application of the X-rays in microscopic work, the new method is attracting much attention among scientists, as it is recognized that it will contribute greatly to our knowledge of minute animal life. Biological and kindred sciences have recourse to the microscope at every moment, but it often happens that specimens are opaque, hence the necessity of making sections of the objects in order to observe their internal structure, but this is well known to be a great disadvantage from the fact that nothing is now left of the exterior of the objects under examination, and besides, the systematic study of sections of an object requires numerous and patient observations in order to reconstitute the *ensemble* from the various details. While the use of the X-rays has been valuable for observing the internal structure of large objects such as can be seen and photographed directly, the fact that such rays do not obey the laws of refraction and cannot be used with lenses makes it impossible to apply them directly for making micro-radiographs.

The problem is solved by M. Goby in an ingenious way by his new method which consists in applying the minute object directly upon a photographic plate and sending upon it a beam of rays which are as nearly as possible perpendicular to the plate, thus avoiding all penumbra and giving a record of all the finest details of the object in its internal parts with such precision that after developing, the minute images thus obtained can be enlarged from 15 to 45 diameters in an ordinary micro-photographic apparatus. On the other hand, the quality of the enlarged image naturally depends upon the fineness of grain of the photographic plate after developing, and he therefore uses a plate which has as fine grain as possible and at the same time is sensitive enough to allow of a reasonably short exposure.

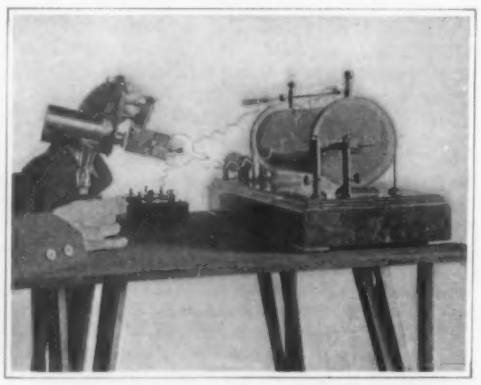
The construction of the apparatus is shown in the photographs, the general iden being to place the minute object directly upon the film side of a small photographic plate upon the base of the instrument and within a dark chamber of cylindrical shape. The X-ray bulb placed at the top of the device sends down the rays through a central tube which serves to direct the rays nearly vertical upon the object and the photographic plate in order to make a "shadow" upon the latter, and the main point in the present makeup is to produce rays which fall as nearly perpendicular as possible to the object and plate, for were this not done and the rays were diffused in various directions, it is evident that the record made on the photographic plate would be blurred by such irregular rays and the minute and delicate outlines of the internal structure would be confused and lost. It would then be impossible to enlarge such a plate so as to obtain a view such as would show all the details to the naked eye.

The dark chamber is made up of a pair of large sliding metal cylinders, the upper one carrying a sliding tube through which the rays pass. The whole device is held at one side by a telescoping support with ball and socket joint so that the apparatus can be raised out of the groove on the bottom plate and turned up so that the observer can look through the lower end of the tube to see that the rays come through properly. On the top is a support for holding the X-ray bulb, provided with rack-and-pinion adjustments so as to set its position at the proper distance from the tube. Turning up the device, the observer sees that the rays fall through the tube as is required, and after adjusting for this purpose, he brings down the dark chamber upon the base,



The X-ray bulb can be adjusted in position so that its rays fall directly on the plate.

all light being thus cut off from the inside. Previous to this he has placed the specimen upon a small square photographic plate, preferably of a fine grain, and directly in contact with the sensitive surface without putting black paper between the two, so that the resulting image or shadow is very sharp and clear. The rays are directed along the axis of the tube by using a small diaphragm at the top, using as a finder a narrow tube near the bottom, so that a vertical beam of the rays comes out of the tube upon the object below in order to make the photographic impression on the plate.



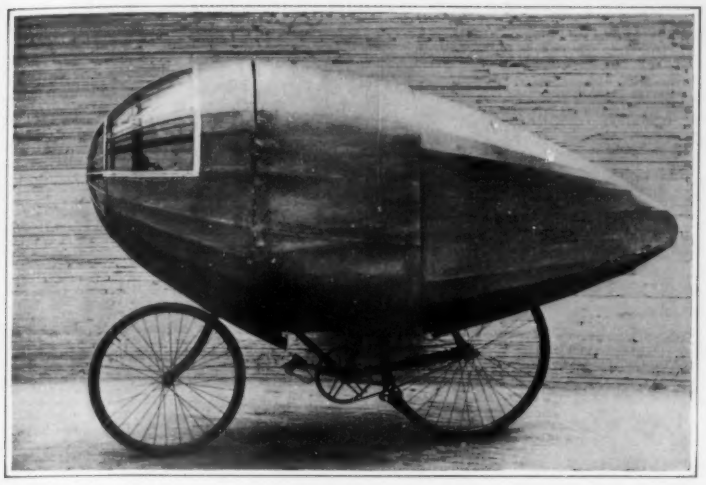
The general idea is to place the minute object directly on the film side of a photographic plate.

The upper diaphragm disk of the apparatus is constructed entirely of very thick lead so as to cut off the passage of the rays except through the small central hole, and below it is a disk, serving as a shutter to stop off all ordinary light rays which might leak in from the top, but allowing the X-rays to pass through. At the lower end of the tube is a finder device which consists essentially of the very narrow metal tube held between the two permeable disks. Below this is a small fluorescent screen fitted into the tube end and covered with a plate of lead glass in order to protect the operator's eye. To make sure that the ray falls just in the center, the X-ray bulb is moved about until the small luminous spot appears surrounded by a small black circle which is the shadow of the small tube and indicates that the rays are quite vertical. Then the finder as a whole is drawn out of the main tube and the apparatus put in the vertical position so as to cover the object as above stated. This latter operation is carried out in the dark room when the photographic plate is put in, the X-ray bulb being now out of action. Then the bulb is set working on the electric current for the required time, varying with the transparency of the object and lasting from one to three minutes. The quality of the rays produced by the bulb can also be varied to suit the case by the use of well known methods. It is also possible to widen or narrow the field of the rays upon the photographic plate by approaching the tube to the X-ray bulb or by lowering it, the tube being made sliding to this effect.

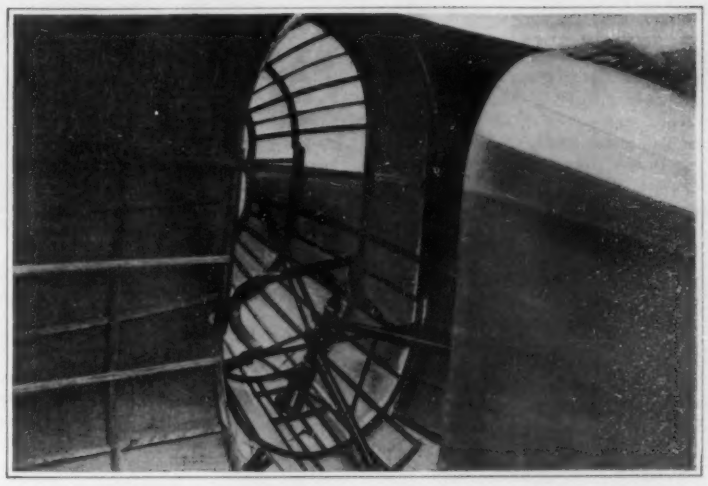
The New Buildings of the Paris University

OWING to the lack of room in the Paris University buildings for the departments of chemistry and researches upon radium, it was decided to erect commodious quarters for such work. The new buildings in the Latin quarter are now almost finished and contain well fitted laboratories and halls. The largest building is the Chemical Institute, which covers an extensive space and is said to be the most considerable in Europe. But it is the new "Radium Palace" which deserves special mention, or more properly, the three buildings which go to make up the Radiology Institute. The first, or "Curie building," is designed for laboratories and courses upon radio-activity, and will be under the special direction of Mme. Curie. Opposite it is a similar edifice built with a subsidy of $80,000 from the Pasteur Institute, to be used for the physiological applications of radium. Between the two is the smallest, but the most interesting building, the "Temple of Radium," which is a veritable strong-box, as it might be called, for holding considerable amounts of radium salts and possibly pure radium. The walls are lined with thick lead sheet, which is needed in order to prevent the emanation of "rays" from passing. We expect to give a further description of these structures when they are fitted up. The present extensive grounds, coming from the demolition of an old convent, will now be an important university center, the first building to be erected here having been the Oceanographic Institute. Another part of the ground will be occupied by the Geography Institution, to be built with a donation of $1,000,000 made by Marquise of Arconati-Visconti, and Architect Nénot is also engaged on the plans for the Institute of Ancient and Modern Art and the Arts Library.

Hogs' Brains are being bought on an extensive scale by a company in Denmark from the abattoirs of that country for use in making lecithin and collestrin, which are exported to Germany and Switzerland for use in medicine.



A wind shield for cyclists with the aid of which Berthet has beaten some indoor records.



Interior of Bunau-Varilla's wind shield. Through the celluloid window in front the cyclist sees the track.

A Wind Shield for Bicyclists

ETIENNE BUNAU-VARILLA, a son of Phillippe Bunau-Varilla of Panama fame, has devised the wind shield for bicyclists which is illustrated on this page. Cumbrous as the shield may appear, we are assured that a French cyclist, Berthet, easily beat various indoor records from one to five kilometers at the Velodrome d'Hiver in Paris.

The following figures are unusually significant because Berthet was not in particularly good physical condition:

The world's record of 1 minute 9 3/5 seconds for a kilometer with a flying start, made by Perchicot, but not recognized, was reduced to 1 minute 7 seconds. This is also better than Dupré's record of 1 minute 10 3/5 seconds, made in 1911 at Buffalo.

Jaap Eden's record of 1 minute 16 3/5 seconds for a kilometer with a standing start, made in 1896 at Bordeaux and never beaten, was equaled.

The world's record for 5 kilometers with a standing start, made by Verlinden at Anvers in 1910 (6 minutes 56 4/5 seconds) was beaten by exactly 1 minute 10 seconds.

The 250-meter track of the Velodrome d'Hiver was covered in 15 2/5 seconds, or at an average speed of 58.450 kilometers an hour.

Berthet recently raced with Egg under ordinary conditions. He succeeded in beating the time he made in that race with the aid of Bunau-Varilla's wind shield, as the following table shows:

	Against Egg.	With the shield.
1 kilometer	1m. 22s. 3	1m. 16s. 3
2 kilometers	2m. 40s. 4	2m. 23s. 4
3 kilometers	4m.	3m. 31s. 4
4 kilometers	5m. 19s. 1	4m. 39s. 3
5 kilometers	6m. 37s. 3	5m. 46s. 4
Average speed per hour	45.3 kil.	51.902 kil.

The last four kilometers in the foregoing test were covered at an average speed of 53.8 kilometers an hour.

These times were clocked by M. Durand, director of the Velodrome d'Hiver. Although not official, they are, however, instructive.

When it is said that Bunau-Varilla has taken a lively interest in aviation, the origin of his windshield is immediately apparent. Those who have followed the development of streamline bodies in airships, automobiles and aeroplanes, will discern at once that Bunau-Varilla has applied to the bicycle a principle which has been successfully incorporated in their vehicles by the more intelligent designers of airships and automobiles.

The wind shield is fish-shaped and consists of a light frame covered with fabric. When the cyclist is bent over in racing position, he is completely housed within the shield. A celluloid window in front enables him to keep an eye on the track.

It is quite evident that the shield is better than the many projecting surfaces which must be urged through the atmosphere when a bicycle is forced along, each surface stirring up the air and leaving eddies behind. With a properly shaped wind shield the air closes in behind the bicycle and the resistance is so markedly reduced that it is easy to understand why indoor records should be broken.

The Soot-and-Dust-fall of English Towns and Cities; 200 to 2,000 Tons per Square Mile per Annum

How it is to be Measured

By John B. C. Kershaw

THE first of October of the past year marked the commencement in England and Germany of a carefully planned and systematic attempt to measure the amount and to investigate the character of the solid impurities present in the atmosphere of many large towns and centers of manufacturing industry.

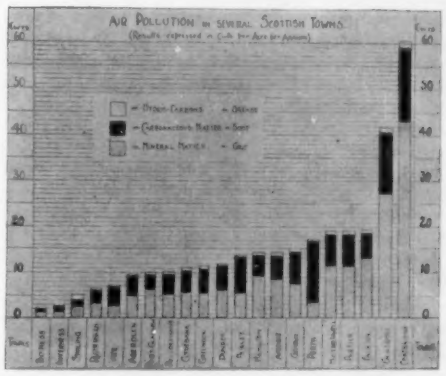


Fig. 1.—Diagram showing soot-and-dust-fall of Scotch towns in winter of 1910-1911, based on observations made by Chief Inspector Fyfe of Glasgow.

Fig. 2.—Plan of standard soot-and-dust gage, showing catchment area.

Fig. 3.—Soot-gage used for London observations of 1910-1911, exposed on house roof at Buckingham Gate. S. W.

Everyone is aware that the air of towns contains a much larger amount of soot and dirt than the air of country districts, for even in New York city, the state of the linen and curtains bears effective testimony to the dirtiness of urban atmospheres. But no attempts have been made until recently to measure accurately the relative amounts of impurity suspended in the atmosphere of the more thickly populated districts of town and country. The figures obtained in the tentative experiments carried out in London, Leeds and Glasgow, by different observers, in the years 1910-1912, are of slight value for comparative purposes, since they have been made by different methods, and under different conditions of observation. The figures so far, however, have revealed the fact that enormous amounts of solid matter are suspended under ordinary conditions in the atmosphere, and are ultimately washed down with the rainfall upon the buildings and streets. Thus, the soot-and-dust-fall observations already made in London, have given totals varying from 195 tons per square mile per annum at Sutton in Surrey to 650 tons per square mile in the East End, London. The experiments at Leeds gave totals ranging from 242 tons in the center of the city to 539 tons at Leeds-Forge; while Glasgow and Coatbridge have exceeded these figures with totals of 1,330 tons and 1,939 tons, respectively. These are staggering totals, when one remembers that this amount of impurity is suspended as a rule in the form of fine dust and soot particles in the atmosphere, and that only after heavy and long continued rain can the air we breathe be considered clean and free from solid impurities. As already stated, the observations made in London, Glasgow and Leeds were carried out under varying conditions by different apparatus and methods, and at the International Conference on Smoke Abatement, held in London in March, 1912, a strong committee was appointed to draw up the details of a standard apparatus and method for measuring the amount of soot and other impurities of the atmosphere. This committee, of which Dr. W. N. Shaw, F.R.S., of the Meteorological Office is the chairman, has held five meetings in London, and has drawn up the details of the apparatus and method which have been chosen as most suitable for the observations required. A circular letter was issued early in the past year to the public health authorities of all the more important English towns and cities, inviting their co-operation in the work, and it is satisfactory to note that the observations commenced in the following important centers on the first of October, 1913: Birmingham, Bradford, Crewe, Exeter, Hull, Leeds, Leicester, London, Malvern, Newcastle, Plymouth, York and Glasgow. The voluntary Association of Steam Users known as the "Hamburg Verein für Rauchbekämpfung" has also agreed to commence observations with the standard apparatus and method in Hamburg. Valuable returns covering a very wide area will therefore soon be available relating to the amount and character of the suspended matter in city and town atmospheres, and with these data before them many of the municipal authorities will have no excuse for ignoring longer the very grave pollution of the air of their own cities.

It may be urged by some critics that, although the figures obtained by the adoption and use of a standard apparatus and method for recording the soot-and-dust fall will be interesting, they will serve no useful purpose, and that the money spent upon the observations could be used more satisfactorily and with greater advantage in other ways. To these critics it may be pointed out that the solid impurities suspended in the atmosphere of all towns and cities are harmful in three ways to those who either by choice or the necessity of

earning their daily bread, live and breathe in this vitiated medium.

First, by diminishing the amount of sunlight which falls upon the earth, these solid impurities suspended in the atmosphere directly lower the vitality of the human organism, and decrease its ability to resist disease. Cohen has shown that, in Leeds, from 25 per cent to 40 per cent of the sunlight is cut off by the smoky atmosphere. In the second place, the soot and dust suspended in the air of all manufacturing towns, enter the lungs and choke up the pores and cells of the lung-tissue, thus hindering that rapid assimilation of oxygen by the blood and discharge of CO_2 and other waste-products, which are essential for the maintenance of health. Finally, direct sunlight and pure air are now recognized as the best of germicides. Smoke and dust, by diminishing the sunlight and defiling the air, therefore promote bacterial life, and are thus helpful in the propagation of all infectious diseases.

In view of these scientific facts, it is evident that any series of observations which will place definite figures for the degree of pollution of town air in the hands of city authorities, and thus enable them to compare the purity of their own atmosphere with that of other towns of similar size and population, will give a real incentive to improvement—a stimulus which could be obtained in no other way. When for example, Glasgow can show by its records a cleaner atmosphere than Liverpool, or Pittsburgh than New York, or Manchester than Leeds, the upward progress will have commenced in earnest, and each city and town will strive to excel its rival in this competition for a purer air. These standard records of atmospheric pollution will also be useful for determining the progress of the district as regards the purity of its atmosphere, when the observations have been continued in one town or city over a period of some years.

The final proof that the observations are worth making and will prove of permanent value is, that the present head of the British Meteorological Office (Dr. W. N. Shaw) would not have accepted the chairmanship of the Air Pollution Committee, unless convinced of the importance of the work which it is proposed to carry out.

The following is the official description of the apparatus which has been selected for making these observations, and of its method of use: The principle of the apparatus and method is the collection of the rainfall in an enlarged rain gage, and the separation from the collected water of the solid impurities which it carries down and retains either in suspension or in solution. The standard gage consists of a galvanized iron stand, supporting a circular enameled iron gage vessel of four square feet superficial area. Projecting above the gage vessel is a wire screen open at the top, intended to prevent birds from settling on the edge of the vessel. The gage vessel is conical at the bottom and communicates, by means of a glass tube and rubber connection, with a group of three or more bottles connected together, and designed to hold one month's rainfall. The rain and deposited matter falling on the gage are collected in the bottom, and are removed once a month for analysis. Fig. 3 shows the gage used for the investigation of London's soot-fall, carried out in 1910-1911. The results of this investigation were referred to in the introduction to this article.

The instructions for use of this standard gage state that it is to be placed if possible on the ground-level in open spaces free from abnormal dust and wind eddies, and that the bottles containing the water and deposit are to be removed on the last day of each month, and replaced by thoroughly clean empty bottles. Before removing the bottles, a brush and a rubber squeegee of standard pattern are to be used to remove any adherent matter. A chemical analysis of the water and deposit is then to be made by a standard method, details of which will be provided by the committee, and a report of the results obtained is to be sent monthly to the central office of the committee in London. At the end of twelve months, the Central London Committee will tabulate all the observations, and will issue their report giving the figures in an easily comparable form. The method, it may be stated, was only selected by the committee after all the known methods had been subjected to careful examination, and the apparatus described above was considered to fulfill best the requirements of a cheap, durable and accurate means for determining the soot-and-dust-fall of large towns and cities.

As an illustration of what can be achieved by this method, a diagram (Fig. 1) is given above, showing the results of Inspector Fyfe's examination of the air of certain Scotch towns, in the winter months of 1910-1911. Wooden boxes, one foot square and one foot deep, were used for catching the soot-and-dust-fall in these observations, and although this method is crude and inaccurate, it serves to indicate the value of the information that will be obtained, by a more scientific application of the method over a wider area of observation. Fig. 2 represents a plan of standard soot-and-dust-gage, showing the catchment area.

The writer will conclude this article by expressing the hope that the scientists who are in charge of the smoke investigation now being carried out by the Department of Industrial Research of the University of Pittsburgh, may be able to co-operate in this movement for measuring the soot-and-dust-fall of our cities, and that they will commence observations with the standard apparatus and method, in New York, Pittsburgh, Chicago, and other towns and cities of the United States of America at an early date.

The author's thanks are due to the editor and publishers of *The Lancet*, London, and to Chief Inspector Fyfe of Glasgow for their permission to make use of Figs. 1 and 3 for the purpose of illustrating this article.

The Renewed Siege of the Antarctic

AFTER a lull following the return to civilization last year of the British and German expeditions, as well as the greater part of Mawson's Australian expedition, a vigorous renewal of south polar exploration is now on the cards. It is practically certain that three large and well-organized parties will sail for Antarctica this year, and there is talk of two or three others. The fact that nearly three thousand men have applied for places on one of these expeditions, many of them offering to pay handsomely for the privilege of facing perils and privations in the frozen wastes, is one of several tokens of the immense vogue that polar exploration is now enjoying, and signal proof that the love of adventure, which, whether confessed or not, is the mainspring of all such undertakings, is not decadent among men.

Recent additions to the Antarctic map have been made chiefly on the side of the continent nearest to Australia and New Zealand, where the region from the Ross Barrier and Queen Victoria Land southward to the pole has been explored by Scott, Shackleton, and Amundsen, and the long coast of Wilkes Land by Mawson and Wild. The principal operations of the new expeditions will be conducted elsewhere.

A British expedition under Mr. J. Foster Stackhouse is planning to explore King Edward VII Land, which lies on the east side of Ross Sea, and as much as possible of the coast extending eastward toward Graham Land—at present a long blank on our maps. Stackhouse regards his undertaking as a continuation of the work carried out by Capt. Scott, and has aroused some rather gratuitous criticism by his use of Scott's name in support of his plans. His contention is that his project was originally discussed with and approved by Capt. Scott, that he has acquired the ship "Discovery," built for Scott's first expedition, and that he proposes to explore a land which Scott discovered.

A large Austrian expedition, commanded by Dr. Felix König, an experienced mountaineer and polar explorer, will go south on the ship "Deutschland," which was used by Filchner's expedition. This party proposes to continue Filchner's exploration of the coast of Weddell Sea, and to establish a base on land, from which three long sledge journeys are to be made by different sections of the expedition; viz., to the south, east and west. No special emphasis appears to be laid upon reaching the pole, the principal object of the expedition being to explore thoroughly the now little-known Weddell Sea side of the continent.

The third expedition definitely planned for 1914 will be commanded by Sir Ernest Shackleton, and proposes to attempt the hazardous feat of crossing the Antarctic continent from the Atlantic to the Pacific coast, a distance of about 1,700 miles—as far as from New York city to Dallas, Texas. Shackleton himself has described his projected crossing as "a longer journey than to the pole and back and infinitely more difficult, because we shall always be advancing over new ground, with no depots to draw upon." It is possible, however, that the party will not have to depend entirely upon its own resources during the latter part of the journey, as it is planned to have an auxiliary expedition land on the coast of Ross Sea and sledge southward along a previously arranged meridian as far as latitude 83, if possible, to meet the explorers coming from the pole. The expedition will have two ships, driven by oil fuel, for the main and auxiliary parties respectively. The sledges, which will perhaps be constructed of steel tubing, will be drawn by dogs, except two, which will be driven by aeroplane propellers. Other novel features of the equipment are under consideration. The expedition goes south next autumn, and Shackleton hopes to complete the transcontinental journey by the following spring, though the entire expedition is not to return before the spring of 1916. It is to be hoped that he will be more lucky than Filchner, who undertook in 1911-13 to make a very similar journey over the same route, but never even succeeded in getting ashore on the Antarctic continent.

At the International Geographical Congress, held last April, Dr. W. S. Bruce outlined the plans of a Scottish expedition, which also proposes to cross Antarctica from Weddell Sea to Ross Sea. A lack of funds appears to have prevented the maturing of this project, and, as far as we know, no announcement has yet been made as to when the expedition hopes to sail.

In regard to the extraordinary announcement in recent press dispatches that Louis de Rougemont, "the veteran explorer," will lead a large expedition to the Antarctic under the patronage of the Australian government, the only comment that need be made for the present is "Interesting if true." De Rougemont achieved notoriety in the year 1898 by a story of picturesque adventures in Australia, narrated at a meeting of the British Association, concerning the veracity of which a long controversy raged in the magazines and newspapers of the period.

A Modern Battle-practice Target

THE naval target shown on the cover of this issue gives a near view, which enables the reader to get a clear conception of the construction and various details of an object which ordinarily can be viewed by the layman only from a distance of many miles.

It will be noted that the target is of simple and rather crude construction. It consists of a submerged hull carrying a comparatively light superstructure. The superstructure of the target shown is thirty feet high by sixty feet long. Its height is therefore approximately the average height of a battleship above its water-line. The length is about one tenth of the overall length of a modern dreadnought.

The hull, or raft, is built up solid of 12-inch by 12-inch timbers, strongly bolted together; and it measures in length over all about 110 feet, in width about 5 feet 6 inches, in depth about 15 feet. The bottom of the hull is ballasted and to each end is attached a heavy chain bridle, to which is made fast the towing hawser.

The superstructure above the deck of the raft (the latter is ordinarily about awash) is the target proper. It consists of a number of stout uprights, across which is nailed a series of horizontal battens or strips of wood. Over this is drawn a net of rather coarse mesh, which is hauled up to the top of the uprights and then drawn taut by blocks and tackle attached to the bolt rope at the bottom of the net and to the deck.

The target is towed, usually, by a battleship, the distance from the ship to the target being ordinarily between three and four hundred yards. The ship that does the firing steams past the target, either in the same or the opposite direction to that in which the target is being towed, and "lets fly" at it. On the quarter deck of the towing ship is a group of officers who observe the fall of the shot. The splash of these is photographed, and, latterly, moving picture machines have been utilized to show exactly what takes place. After a ship has fired, the "seamen" lower a boat, row over to the raft, and take down the net, which is then spread out on the deck of the firing ship and the number of holes is counted.

The Current Supplement

IN this week's issue of the SCIENTIFIC AMERICAN SUPPLEMENT, F. Donaldson discusses the proper methods of sinking and lining shafts so as to avoid heavy fixed pumping expense after the completion of the mines.—G. A. Cromie, superintendent of trees, New Haven, reports on an unusual case of electrical injury to street trees.—A comparative estimate of the cost of power from coal and from solar radiation, based upon the performance of the plant in Egypt is published in this issue.—R. Thurston Kent, writing on economies in shop transportation, shows how loss of time between machine operations can be reduced by judicious equipment.—H. C. Plummer contributes an excellent article on the "Soo" Canal at the outlet of Lake Superior, where the world's greatest inland traffic by water passes.—F. A. Perret discusses the causes of the ascent of lava from the interior of the earth.—Most useful information on the causes of the bursting of flywheels and the proper methods to be adapted to provide safety against such accidents will be found in an article dealing with this subject.—H. L. White discusses the influence of bran extracts on the baking qualities of flour.—F. Oswald writes on the Sudden Origin of New Types.

Effect of Hydrochloric Acid on Silica

SOME very singular and unexplained effects of hydrochloric acid upon silica are brought out in M. Armand Gantier's paper recently read before the Académie des Sciences. In his recent experiments on this subject Gantier finds that the effect of the acid varies widely according to the form of the silica. In the shape of rock crystal, the acid attacks it but slightly. Some action can be detected when the crystal is cut parallel to the axis, but it is practically nothing upon the surface when cut across the axis. The reason for this difference is unknown as yet.

Radium in Cancer

Its Scope of Usefulness and Its Limitations

By Worthington Seaton Russell, M.D., Research Fellow and Chief of the X-ray Department, New York Skin and Cancer Hospital

RECENTLY the daily press has extensively exploited the alleged claims of two well-known members of the medical profession that in radium has been found the long-sought-for cure for cancer.

Articles have appeared in the leading newspapers of all sections of the country, a sample of which I have before me in a clipping from a Syracuse paper with the very positive and convincing headline, "Radium Rays Cure Cancer in Forty-eight Hours," and again in the text, "Cancer is curable and cancerous growths which had resisted every other treatment invented by science *have been cured in forty-eight hours* by the marvelous properties of radium." The italics are mine.

Many "sure cures" for cancer have arisen, owing in great part to the publicity of the subject following an effort of the profession to properly educate the public regarding the importance of an early diagnosis and prompt and proper treatment. There is but one universally recognized cure for cancer—the knife. Those competent to speak authoritatively because of experience with the various methods of treating cancer are unanimously agreed that the early, complete and radical operation is the safest method known to the profession at the present time.

Just as the earnest efforts of those interested in the popular campaign against cancer are beginning to bear fruit and our patients are realizing the necessity of operation, comes the positive statement, heralded all over the country, that the dread disease can be cured by radium. The statement is all the more harmful because it purports to come from eminent surgeons, and further because there is an element of truth in what has been reported.

This arousing in a credulous public of the false hope of a cure does incalculable harm. Many sufferers will defer operation until too late, hoping to avoid the use of the dreaded knife, others will spend hard-earned savings in an effort to receive the treatment and many other unfortunate victims will fall into the hands of the numerous quacks whose only claim to radium is in the use of the name in their advertisements. We hear the heart-rending story many times at the New York Skin and Cancer Hospital—the story of the trial, first of this cure, then of that, the eager and anxious waiting for the promised improvement, the consequent despair and the taking up again of the search for the "sure cure," which is never found, until finally the poor sufferer drifts into the hospital, demanding in the name of humanity that "something" be done to relieve the awful suffering. Everything possible is done, but with quite a different outcome than if the patient at the very outset had fallen into the hands of one competent to give advice.

It is not so long ago that we read in the papers of the long line of consumptives, hopeless yet always hopeful, anxiously awaiting the extensively advertised opening of an "institute" for the cure of tuberculosis by the use of a "turtle" vaccine. The doors never opened, and many a sufferer who had spent his last cent upon a long journey had to beg his way home, there to die because the exertion sapped the little vitality he had, and because of the realization that he had been duped and there was no hope for him. There is no more damnable scheme than that which works upon the credulity of the incurable sick with the promise of a cure.

Now comes the cancer cure by radium. That radium has its field of usefulness in the treatment of certain conditions, particularly of benign growths, is not to be denied, but the statement of enthusiatic advocates that the radio-active material will cure cancer is to be challenged. A proper degree of enthusiasm is laudable, but only when it is tempered with scientific skepticism. Those who have had the most experience with radium are not prepared to state just what the effect is upon cancer. The crucial point is, just what may be considered a "cure" in cancer? We have seen many cases come to the hospital in which the primary growth had disappeared under radium irradiation, but with immense metastases appearing some months afterward. Is it justifiable to record and report such cases as cures? Decidedly no. A case cannot be said to be cured of cancer until five years have elapsed without a recurrence. We are testing many methods of treatment at the Skin and Cancer Hospital, but while we are getting interesting and encouraging results from some, we would not be dealing honestly with our patients nor with those who look to us for our opinions, if we made more positive statements for some time to come. This new method of employing the various radioactive substances in the treatment of cancer should be thoroughly, carefully and scientifically tested by those especially trained to carry on the correct technique, and then, after the proper period of time has elapsed to make the results of real value, a conservative report should be published with an estimate of the worth of the method.

Great have been the triumphs of medical science in recent years. Some of our worst foes—diphtheria, typhoid fever, small-pox, etc., have yielded to methods based upon modern bacteriology. Unfortunately the methods so successfully employed in the instances cited, fail completely in our fight against two of the worst enemies of mankind—tuberculosis and cancer. What then are we to do? Are we to fold our hands in our laps while awaiting the deliverer who shall free us from these bonds?

There is an old adage that prevention is better than cure. Where the prospect of a cure is at the best very uncertain, this truism acquires special significance, and thus the warfare against tuberculosis and cancer has been largely a warfare of education—the dissemination of knowledge regarding the causes and modes of transmission of these scourges. In the case of tuberculosis this mode of attack has been most fruitful of results. It has been the hope of the medical profession that something at least could also be accomplished in this way in the warfare against cancer. The people have been warned of the nature of the first indication of cancer and of the deadly danger incurred by delay in consulting a competent surgeon, or by failing to follow his advice when the knife must intervene.

It is to be greatly regretted that much of the good that such a campaign may have accomplished, must have been undone by the sensational newspaper accounts and scare headlines which have recently proclaimed alleged healing powers, little short of miraculous, for radium in the treatment of cancer.

The truth is that radium has for many years past been employed as a remedial agent against certain superficial growths somewhat akin to cancer, and that some good results have been obtained. But the field of usefulness for the substance has been quite limited, and there is at present no basis for the belief that recent developments so glaringly displayed in the newspapers will bring any immediate advances of a startling character. At the best many months, if not years, must elapse, before any certainty can be reached, and before the general public can profit by a new remedy which has not yet passed out of the experimental stage. In the meanwhile many may be misled by a false hope, or may defer the life-saving operation, and incalculable suffering may thus be caused.

It is with these facts in mind that we gladly open our columns to a statement from the pen of Dr. Worthington Seaton Russell, an expert in the field of cancer treatment and research, who, in answer to many inquiries received at the hospital to which he is attached, has made an authoritative statement for publication in the SCIENTIFIC AMERICAN *and the Crouse-Irving Bulletin, regarding the present situation.*—EDITOR.

The effect of radium cannot be correctly judged unless comparatively large amounts of high radioactivity are employed and unless the proper technique is used. The employment of a radium salt with a low activity, although the bulk may be large, will not produce results. It is said that one surgeon who was using a considerable quantity of a "radium preparation" without result had it tested by a reliable expert, and was told there was no trace of radium whatever in the material.

For several years Dr. Bainbridge, director of the Cancer Research Department at the New York Skin and Cancer Hospital, and I have visited the Laboratoire Biologique du Radium at Paris, the London Radium Institute and the other institutions using radium, with a view to watching the work they have been doing. The Paris Laboratory is one of the most important, at the same time being the oldest institution devoted exclusively to the use of radium.

We have been using radium at the Skin and Cancer Hospital and are acquiring a larger quantity of a high activity in order to give the method a thorough test.

Drs. Wickham and Degrais, who have been in charge of the Paris Laboratory, read a paper at the International Congress held in London last summer on "Can Radium Help Surgery in the Treatment of Malignant Tumors?" from which paper I will quote some of the writers' views. They advocate operation in all operable cases to be followed by application of radium if a recurrence is to be feared. In those cases in which the growth is difficult of operation they advise radium treatment both before and after the operation. Several investigators have claimed that radium may in some instances convert an inoperable growth into an operable one.

The authors admit that radium has only a local and palliative effect, still in certain cases of cancer a state of apparent cure has remained for several years.

The London Radium Institute was opened in August, 1911, and the first report appeared in the early part of last year. The Institute has the largest quantity of radium of any in the world, and therefore it has not been limited in its work for a lack of the material. The report, therefore, is of value, especially as Dr. Pinch, the medical superintendent, is careful in his attitude toward the method. A total number of from six to seven hundred cases were treated, including 134 patients suffering from epithelioma. Of this number 7 were "apparently cured," 39 decidedly improved, 22 died, 20 showed no improvement, 23 abandoned treatment, 15 received prophylactic raying, and 8 were too recent to be classified. We must exclude those cases that discontinued treatment, those that received the prophylactic raying and the recent cases, leaving a total of 88. Of this number 25 per cent died, while there was cure or improvement in 52 per cent. The report advises operation in all operable cases. The results in cancer of the rectum were not as favorable, although it is claimed that in some instances the growth diminished in size, making it possible to remove the tumor by surgical means.

The most successful treatment was with rodent ulcer, an almost non-malignant affection. Dr. Pinch states in the report, "Rodent ulcer is, of all the forms of malignant diseases, the one which is most amenable to the action of radium."

The prophylactic irradiation was employed as a post-operative procedure, and of those so treated only a few showed recurrence. There is a fibrous transformation which serves to arrest hemorrhage and to prevent the dissemination of cancer cells by sealing the lymph vessels.

It must be remembered in analyzing the report that only the most hopeless cases apply for relief and further that Dr. Pinch has classified as "apparently cured" those cases that present a "condition in which all traces of the original lesion have disappeared, in which there is no sign of recurrence and in which the patient is free from any external indication or symptom of the disease."

Dr. Knox, in charge of the radium treatment at the London Cancer Hospital, finds that "operation gives the safest, surest and quickest results in all cases of early cancer, but that radium should be used as a useful adjunct following operation." In common with many observers he states that the X-ray may be as useful as radium. The one advantage that radium has over the X-ray is that several tubes containing the radium may be buried in the substance of a growth and left there for a long period of time.

One effect has been noted by some observers, and that is that where a primary growth has been rayed the recurrences which appear on the same site are much more resistant to further action of the radium than was the primary lesion or the secondary tumors which may occur outside the field of the first raying.

I have purposely said nothing of the universal success in the treatment of *benign* conditions, as keloid, nævus, angioma and the like; here one can speak enthusiastically enough, but these facts are well known to the profession.

Except in the case of superficial epitheliomata without secondary involvement and in certain forms of sarcomata, which are not very malignant, there is no warrant in proclaiming radium as a cure for *malignant* tumors.

At the annual meeting of the New York State Medical Society last spring, an enthusiast, in speaking of the use of radium, stated that if he had a sufficient quantity he would transcend the acts of the days of the apostles. I can second Dr. Bainbridge, who replied that he, too, had been fired by the same enthusiasm, but after repeatedly visiting the European centers where radium was being tested, he had seen nothing to prove that we had a new specific remedy for cancer.

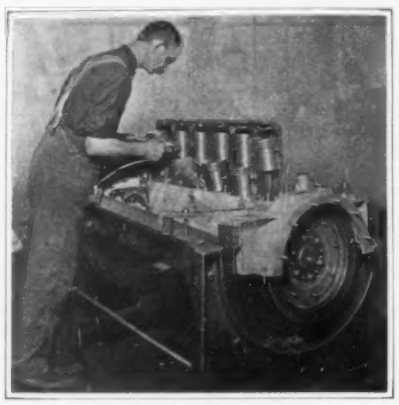
BOYS' READING CLUBS

Selecting connecting rods in sets of uniform weight.

Going Through the Shops—III

The Associate Editor of the Scientific American Witnesses Some of the Methods Used in Obtaining Extreme Accuracy in High Grade Motor Cars

By A. Russell Bond



Lining and truing up the pistons of a six-cylinder motor.

THE paper upon which the SCIENTIFIC AMERICAN is printed measures three one-thousandths of an inch in thickness, a measure too small to be observed with the naked eye. Yet an automobile manufacturer would hold up his hands in horror if you showed him a piston or cylinder that varied from his stardard by anywhere near that amount. Split this paper into six leaves; wrap one of the leaves around a piston of standard measure and you will have increased its diameter by only one one-thousandth of an inch. If then you could insert this piston into its cylinder, the cylinder would probably be rejected as too large, or if accepted, you would be informed that it represents the absolute limit of departure from perfect accuracy. We are accustomed to saying that there must not be a variation of a hair's breadth, believing that to be the acme of accuracy, but a hair's breadth may be three one-thousandths of an inch or more, whereas in the important part of an automobile motor, one one-thousandth of an inch represents the extreme variation permissible in the more important parts of an automobile motor, and some parts have to be ground down to within half of a thousandth of an inch. A common method of testing cylinders is to provide two plug gages, one of them marked "go" and the other "no go." If you pick up these gages you will note that the exact diameter of each is given down to the thousandth part of an inch and that the plug marked "no go" is but one one-thousandth of an inch larger in diameter than the other. The cylinder must be finished to such a size that the "go" plug will enter it and the "no go" plug will not.

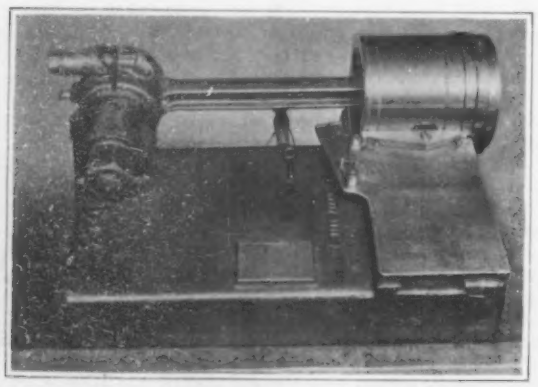
An essential part of every automobile factory is the maintenance of micrometers and test gages. Thousands of dollars are spent on the gage equipment. A machine cannot be depended upon to cut the work with perfect accuracy, for the cutting tools are bound to wear. Furthermore, a tool, even on a finishing cut, does not leave a perfectly smooth surface. Some manufacturers believe it desirable to leave a mat surface on the inner wall of the cylinder, so that it will hold a film of oil. Other manufacturers believe in grinding both the cylinder and the piston to a perfect fit. While the cutting tools cannot be maintained to a perfect standard of accuracy because of wear, the same is true, although in a far less degree, of the gages. Some manufacturers depend upon micrometers and gages made by manufacturers of precision instruments. Others, not satisfied with that, go to the extreme of using master gages with which their micrometers are tested from time to time. These master gages are rectangular pieces of metal, with perfectly true faces and conceded to be the most accurate pieces of mechanical work in the world. Their accuracy is guaranteed to the ten thousandth part of an inch. If two of these pieces be rubbed together to remove the film of air between them they will fit so perfectly as to adhere tenaciously. With such master gages as these, the micrometers are tested from time to time and corrected, and with these micrometers the various gages of the machine shop are in turn tested and kept in perfect condition.

The automobile engine is a high speed machine, and it is absolutely essential to have perfectly fitting parts, for, with the piston reciprocating a thousand times a minute, the slightest looseness would soon develop into serious wear, loss of power and eventually breakage of parts. Of course, no matter how perfect the fit of a piston in its cylinder, it is necessary to use piston rings to prevent leakage of the high pressure gases. To form these rings so that they will bear evenly on all parts of the cylinder while in operation calls for expert designing. One of the accompanying illustrations shows a fatigue test to which certain piston rings are subjected. The piston rings are cut from a cylinder or "pipe." In order to determine whether the piston ring has the requisite amount of resiliency a sample is taken from each pipe and the ring is held open by a suspended weight of about 12 pounds, as shown in the photograph. The sample tested is always the first ring cut, which is looked upon with the most suspicion. The rest of the rings are supported on a peg above the one that is being tested. The 12-pound weight must bring the ring open about 1¼ inches. In that position it is held for twenty-four hours, and then when the weight is removed it must spring back to within 3/16 of an inch. If it fails in this fatigue test, all the rings from the same pipe are thrown out. Not only must there be a perfect fit of the piston in the cylinder, but there must be perfect alinement of the piston in relation to the crank shaft bearing of the connecting rod. One of our illustrations shows a gage used for this purpose. The connecting rod with its piston is supported in the gage with the crank shaft bearing fitted upon a mandrel. A gage lever is then pressed against the side of the piston, and if there is any variation from correct alinement, the variation is shown by a pointer that multiplies the slightest discrepancy. In this alinement gage no variation is permitted, but the pointer must register exactly on the zero point. To determine whether the connecting rod has become bent or twisted ever so slightly another gage is used with which the variation is shown by a multiplying lever, and if it is more than one one-thousandth of an inch the connecting rod is rejected. In order to balance the parts perfectly the pistons and connecting rods of each engine must weigh alike. At the top of the page may be seen a man weighing connecting rods and assembling them in groups of six of equal weight for a six-cylinder engine. At the opposite side of the page may be seen the method of lining and truing up the pistons of a six-cylinder engine.

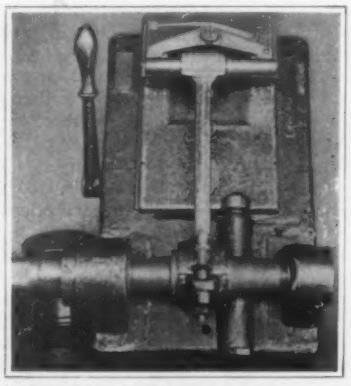
Piston rings undergoing a fatigue test.

The crank shaft is another element of the machine that requires perfect balancing. The shaft is mounted on knife edges, so that if there is any preponderance of weight in any of the crank offsets, the fact will be determined by the turning of the shaft. Not until a shaft has been so balanced that it will maintain itself stationary when turned to any angle, is it accepted for service in an automobile. No less important is the cam shaft. Our illustration shows two tests to which the shafts are subjected. In one of them the bearings of the shaft are being gaged to see if they are true, or if any eccentricity has developed in grinding them. In the other test the relative positions of the cam swells are being gaged. The wheel at the end of the shaft is indexed, and as the different cams are fitted into the gage block the pointer shows on the index whether the swells bear the proper angular relation.

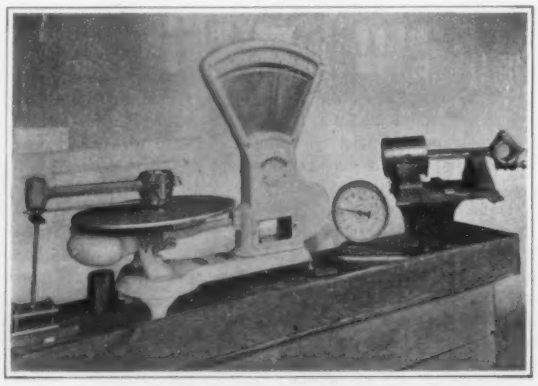
Outside of the motor proper more attention must be given to the gears than any other one part. Spur gears may be cut very accurately, and if necessary ground after being hardened. To test the gears it is customary to revolve them in mesh with a master gear, then the play of the gears toward and from each other, if there be any eccentricity, may be detected by watching an index mark through a magnifying glass. Bevel gears, however, present a more serious problem, for the reason that the cutting of the gears is a complicated process. If the gear is to be hardened after the teeth have been cut, it is sure to be warped out of shape and must be straightened in a press. It is impossible to grind the teeth perfectly true, owing to their tapering shape, and so, if noise is to be avoided, it is customary



Checking up the alinement of the piston.



Testing alinement of the connecting rod bearings.



Weighing the reciprocating parts of a motor.

to test the gears by revolving them in mesh at high speed and listening to see how much noise they make. Each bevel gear is tested with its pinion, and when two are found that mesh with little noise or practically no noise, they are tied together and passed on to the assembly department.

To avoid noise in spur gears, spiral-toothed gears are largely used. One manufacturer has developed a similar method of overcoming noise in bevel gears. The teeth of the bevel wheel are given a spiral form, so that there is a more continuous engagement of the teeth, and even should the teeth not fit as perfectly as those of a well-matched pair of straight bevel gears they will mesh with practically no noise.

Quiet running is a mark of high-grade workmanship. Special types of engines have been invented to reduce noise, but manufacturers of the standard type find that by using special refinements here and there and a higher class of workmanship, much of the noise that used to be considered essential in the poppet valve motor may be eliminated. One of our illustrations shows the care with which high-grade motors are tested. The engine has gone through the usual test, running many hours under a partial load until all the parts have eased up and are working smoothly. Now it is taken into a room apart, where all noise is excluded. An inspector then goes over the machine with a stethoscope, just as the physician examines the human motor, and he searches for the slightest scraping, throbbing or knocking in any part of the engine which might indicate tightness or looseness. Not until the motor physician is satisfied that every part is working with perfect smoothness is the engine turned over to the assembly department, there to be mounted in the chassis with the transmission gear and run again on a dynamometer test, or on a road test around a specially prepared testing track. Finally after everything has been done to develop latent symptoms of trouble, the body is mounted on the machine, and the finished automobile emerges from the factory.

A Folding Wheel-Chair

THERE is no problem in life that is not fit material for the work of the inventor, and many are the situations where the contriver comes to the aid of nature and supplies some comfort or neccessity, which tends to lessen the misfortunes of humanity. A case which solves this is shown in the construction of a folding invalid wheel chair. A merchant of New York has an invalid daughter, who, because of an accident, was rendered unable to walk. The girl had at her disposal her father's automobiles, but there was the disadvantage that unless a wheel-chair was provided at the other end of the trip the girl could not leave the car, as the only way she could move around from place to place was to be assisted about in a wheel-chair or perambulator. The ordinary wheel-chair was too large and clumsy to go into the body of the automobile, and the girl was forced to remain at home.

The father wrote to various companies to find out whether they would not undertake the construction of a folding chair, such that it could be folded up and stowed in the body of an automobile. None of the companies that manufacture wheel-chairs was willing to undertake such a vehicle, as it did not seem practical.

But by chance, at one of the wheel-chair factories, a new superintendent, in looking over old orders, came upon the letter of the merchant concerning the building of a special folding wheel-chair. The superintendent was at once interested, as it happened that he, too, had an invalid daughter who was unable to walk. Believing that such a folding structure was possible, he obtained permission to attempt the construction of one, the success of which is shown in the following description of the device:

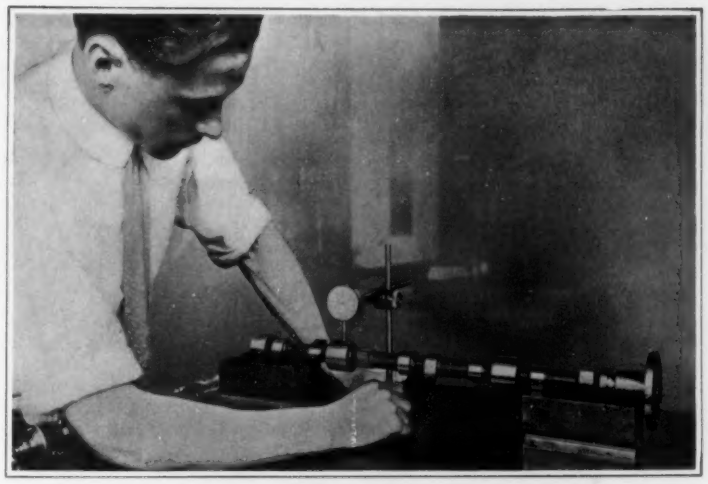
The frame of the chair is made of seamless steel tubing, bent at the corners in graceful curves, and upon this framework is fastened the wooden body, which is made of thin veneer about half an inch thick. The whole body is upholstered in a gray corduroy and is very comfortable when one considers the weight and the space involved. The finish is in maroon enamel and nickel trimmings to match the automobile in which it is carried. The wheels are of the bicycle type with solid rubber tires and ball-bearings. The hubs are made especially narrow to provide for closing into a small space.

Some idea of the folding qualities can be gathered from the fact that the chair folds from 48 inches in height, when "set up," down to 13 inches. From front to rear it folds from 38 inches to about 30 inches, while in width it does not decrease at all, but remains at about 20 inches.

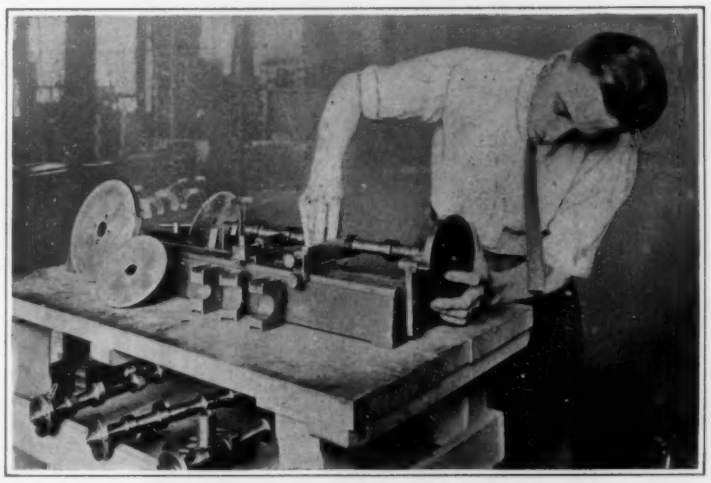
In folding, the chair rolls up somewhat like a bolt of cloth. First of all the sides or arms are folded inward toward each other. Then the back is folded forward and down, and the handle on top of it. Then the braces that hold the wheels are released. The small side boards at the foot are folded toward each other, and the foot-board with the small front wheels attached is folded up against the front of the chair. Then the whole front part of the chair with the foot-board and the wheels, is folded upward and parallel to the back. The large wheels are then closed toward each other and a strap is passed about the whole, and it is ready for carriage.

The weight of the chair is about 70 pounds, which is not any more than the ordinary non-collapsible article. Due to the small space occupied when shut up, no difficulty is experienced by a single person in carrying the device. Folding or unfolding can be accomplished by one person alone in from 30 to 40 seconds.

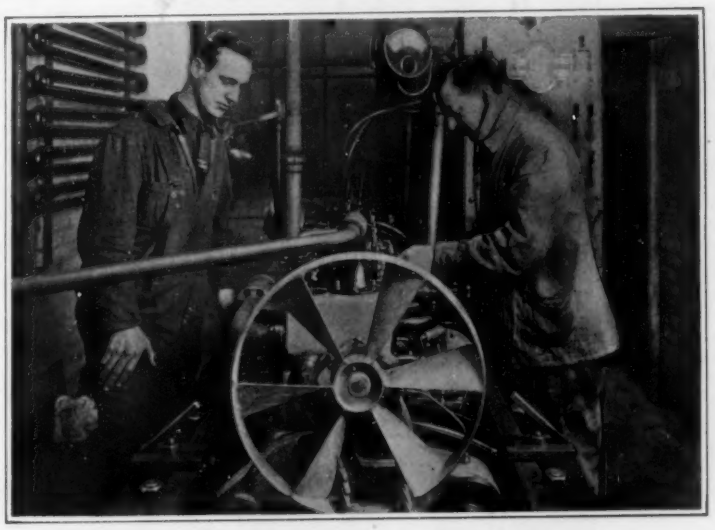
The chair was forwarded on completion to the merchant, and it fully met with his approval.



Hunting for eccentricity in the cam shaft bearings.



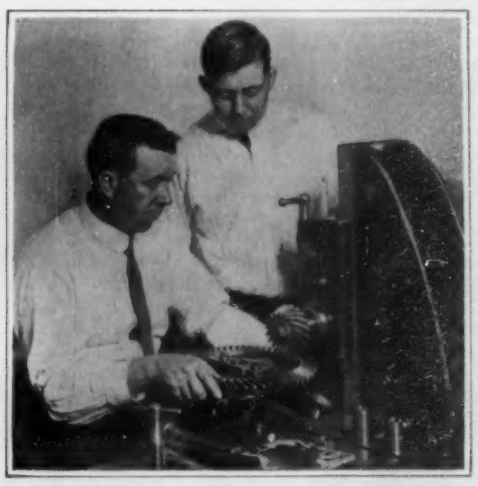
Checking up the angular location of the cam swells.



The motor physician hunting for trouble with a stethoscope.

Testing gears for eccentricity.

Mating bevel gears to run without noise.



Testing noiseless spiral bevel gears.

Farm for Jungle Folk

Feeding the Animals of a Zoo and What it Means

ONE of the most novel and least known agricultural and live stock enterprises probably in New York is the Jungle Farm, where the food is raised for more than five thousand animals, birds, and reptiles, exhibited in the New York Zoological Park. Its output includes everything from young pigs for the big python to lettuce, celery, raspberries, strawberries, honey, etc., for the smaller denizens of the cages. It is located in a secluded valley in Bronxdale, east of the Bronx River, between Boston Road and White Plains Avenue, a quarter of a mile distant from the great highways of travel. It covers six acres of land, and is one of the most essential parts of the complex machinery for the maintenance of the zoological collection, the largest in the world. The superintendent of the Jungle Farm is Mr. Earnest Costain, who has a dozen or so of men to assist him in carrying on his work. The more than 1,000 different species of wild creatures in captivity in the Zoological Park have possibly a wider range of appetite than the throngs of people catered to by a great metropolitan hotel. The farm produces all the various favorite food-stuffs, such as corn, carrots, beets, cabbages, turnips, mangels, and other things to delight the appetite of the vegetarians among the jungle folk. The several breeding houses raise chickens, rabbits, guinea pigs, rats, mice, pigeons and squabs by the thousands for use of the carnivorous birds and big serpents. This great outdoor plant for the feeding of wild things from the ends of the earth was established because the open market could not be depended upon to furnish the large and varied list of foodstuffs required to satisfy the finicky tastes of these feathered, furry and scaled captive boarders from every clime. Their food tastes differ far more widely than those of a collection of the races of the earth. Aside from the necessity of keeping these valuable living specimens in perfect health, as far as that can be done by a carefully studied diet, the Zoological Park has found that it saves about fifty per cent in the cost of furnishing the supplies. Further than that, there is never a chance of shortage, as a great reserve stock of food of all sorts is kept constantly on hand. Every day a wagon takes over to the Zoological Park from the "Nursery," as the Jungle Farm is officially called, a big assorted load of fresh vegetables and fruit for the hungry boarders. Piled on top are the boxes containing the day's supply of chickens, guinea pigs, rats, mice, and other choice morsels for the meat eaters. The vultures, hawks and owls and other such sharp-beaked birds of prey know almost to the minute when their rations are due. Everything has to be absolutely hygienically clean. This is especially the case regarding the animal food furnished the carnivorous birds, animals, and reptiles. Infection of every sort is guarded against most carefully, for every specimen in the great park has a definite value. Some of the birds and beasts are priceless and have cost much money and the risk of many lives to secure. Owing largely to the care that is exercised in growing the food for the great collection of living creatures in the Zoological Park, and to the skill with which it is prepared and served, cases of illness among the "boarders" are very rare. The daily supply of vegetables and rations that comes from the farm is deposited with the cook, who weighs and arranges them in piles. The keepers then come with their push carts and load up their allotted rations and return to the various buildings to feed the animals. Here is a list of the number of livestock and quantities of vegetables that were raised last year and fed to the great army of housed animals and birds: 105 pigeons, 16 ducks, 2,600 chickens, 1,103 rabbits, 1,283 guineas, 762 mice, 2,735 rats, 2,000 worms, 22,958 eggs, 25 pounds honey, 44 pigs, 50 sparrows, 150 pounds grapes, 50 bushels chickweed, 60 quarts of strawberries, 20 tons mangels, 900 bushels beets, 30 barrels potatoes, 1,500 roots celery, 3,000 lettuce, 2,000 cabbage, 5,000 ears corn, 2 tons cornstalks, 40 bushels tomatoes, 20 bushels turnips, 50 quarts raspberries.

For most of the large carnivorous animals the meat is not cooked, but fed raw. For a change, several horses a week, after being pronounced fresh and healthy by the veterinarian, are also slaughtered and added to the meat courses. The food for the great collection of reptiles, giant pythons, cobras, boas and others, demands a special care. One of the largest and most showy of the inmates of the Reptile House is the huge regal python, nearly 24 feet long and weighing over 200 pounds. This mighty serpent possesses a color-pattern of a richness that rivals oriental tapestry, together with an iridescence which gleams in all the highlights of its folds. During the first few months of confinement very large specimens of this snake appear to suffer from the restraints of captivity. They steadily refuse food, and if energetic measures are not employed, they become emanciated, and gradually starve to death. Whenever the big python is found languishing and approaching toward a suicidal end, it is necessary to feed it by force, and thus either awaken or counteract its sluggish appetite. Young rabbits are killed and tied together with brown twine, the snake is held by the keepers in as straight a position as possible, when by means of a pole the meal is forced down its throat a distance of about six feet, and offering a

Thousands of white rats are raised and fed to serpents and large birds of prey.

Very young chicks, a dainty meal for snakes, alligators, or lizards.

Rabbits bred on the Jungle Farm are fed to the big pythons and other snakes.

novel and spectacular performance. Food thus administered usually changes the snake's demeanor toward captivity. With the meal once digested, there comes an appetite for food, which usually can be detected by the snake's actions, although for a time the reptile may lack sufficient courage to feed voluntarily. Careful attention on the part of the keeper is usually successful, and renders a repetition of compulsory feeding unnecessary. At present there is great relief to the keepers of the Reptile House as the giant python is feeding voluntarily on a 35-pound freshly killed pig. This meal is sufficient for several months. The king cobra is a cannibalistic species, in captivity usually refusing everything but snakes. Most of the other serpents, alligators, lizards, etc., feed upon young chicks, pigeons, rabbits, guinea pigs, rodents, all freshly killed, and devoured whole. Eggs are also swallowed entire.

The Cleaning of Scientific Instruments Composed of Glass

By Albert B. Owens

IN making accurate estimations involving measuring certain fixed volumes of fluids, the perfect drainage of the fluid from the walls of tubes and flasks is a point that cannot be overlooked in exact measurements.

When the walls of a burette or flask show drops of fluid adhering after emptying them, it is a certain sign that they are not clean. This is due either to the presence of fatty, oily, or resin substances often too minute for the eye to detect.

In order to overcome this difficulty the flask or tube should be treated with the following solutions in this order:

To remove saponifiable oils (vegetable or animal origin):

1,000 cubic centimeters alcohol 95 per cent (denatured or straight ethyl).
100 cubic centimeters water.
100 grammes caustic potash.

This formula is made by dissolving the alkali in the water first and then mixing it with the alcohol. Allow this solution to act one hour, then return to stock bottle and wash instrument thoroughly with water.

To remove resinous matter such as varnish, shellac, etc.:

500 cubic centimeters acetone.
200 cubic centimeters ether.
100 cubic centimeters coal tar benzole.

This will prove very effective, in about 30 minutes, depending on the thickness of the film.

To remove deposits of carbon, left as residues from distillation in the bottom of test tubes, flasks, and retorts from oil and tar distillations:

1,000 cubic centimeters hot water.
200 grammes potassium bichromate.

Stir until the bichromate dissolves, then cool, and add gradually with constant stirring 900 cubic centimeters of cold, strong commercial sulphuric acid. To clean with this solution, half fill the flask to be cleaned with the bichromate mixture, and rapidly heat to boiling over a Bunsen flame. A rapid oxidation of all the carbonaceous matter occurs, the bichromate solution being reduced to a bright green color, and all of the carbon removed. This method of cleaning should be used after the other two methods fail to effect their object. There are of course other powerful cleaning agents like fuming sulphuric acid, but they are not common in most laboratories, and are expensive.

Forcing Strawberry Plants by Means of Ether Vapors

AMONG the several methods of forcing plants, hot-baths have been used with excellent results, but quicker and better results may be reached by submitting the plants to the vapors of ether. It is not very long since this treatment of the plants has been put in practice in hothouses, but so far it has always given excellent results.

Mr. G. Bultel, a French horticulturist, writes the *Revue Scientifique*, has utilized this method for forcing strawberry plants, and in each and every instance, the plants so treated have borne berries far in advance of those untreated.

His latest experience, made in the winter of 1911-1912, was with 600 plants, of which 300 were treated with ether vapor and 300 with hot baths. The 300 etherized plants were divided into two lots of 150 each. One lot was exposed to the vapors of ether in a closed house for forty-eight hours. The other was subjected to the same anæsthetic for sixty hours. Notwithstanding the difference in length of treatment, the results were only slightly in favor of the plants subjected to the longer exposure.

The following table shows the results he obtained with both treated and untreated plants, showing the considerable difference between the two:

Number of plants.	Untreated.	Treated.
Blooming on January 8th, 1912	33	107
Blooming ended	January 29	January 16
First maturity	March 6	February 21
Last maturity	April 15	March 15

The exposure of the plants to the fumes of ether shows therefore a very decided improvement upon the earlier productiveness of the plants, and should be therefore of great advantage to the grower.

A Non-sinkable Mattress

IT is not a flood disaster that is depicted in the accompanying photograph; not an unfortunate victim washed out into the river, bed and all; but merely a striking demonstration of a new unsinkable mattress. The bed with a mattress strapped fast to it is floating down the River Seine, Paris, in the presence of thousands gathered on the Pont Sully. A special buoyant fiber is used for the filling of the mattress. The inventor of this novel life preserver believes it essential for the equipment of every passenger-carrying vessel, so that in case of danger, one need merely pick up his own bed and use it as a raft. This novel demonstration was witnessed by the Assistant Secretary of Marine of France and a number of other officials.

A Razor That Chops the Beard

FOR the benefit of the man with heavy beard and tender skin a razor has been invented which cuts the beard by a chopping action. An electric motor is connected by a flexible shaft to the shaft of the safety razor. On the end of the razor shaft cylindrical cams are provided which change the rotating movement to a reciprocating one within the bladeholder. At the end of the holder this motion is again changed to one at right angles to the former, by means of a rocking arm and two prongs. Therefore the final motion of the blade is also a reciprocating one, causing the blade to act by means of blows against the hair. Many blows per second are administered, depending upon the revolutions per minute of the motor. The action of the blade is therefore not really one of merely cutting, but rather of severing by blows. The logical result is that it is not necessary to have the blades as sharp as it is now demanded. The chief advantage, however, is the rapidity with which a first-class shave can be accomplished, two to three minutes are sufficient. An application of soap is not necessary, wetting the skin will be sufficient. The sensation after the shave is very agreeable, resembling that of a mild massage. The motor may be connected by a plug with any lamp socket. It takes about 25 watts. The picture shows a combination set, the fan being intended for the use of the lady for drying her hair.

Laminated Gears

THE gear wheel has undergone but very slight changes in its production or design for many years past. Manufacturing methods are carried out upon either of two lines—casting, or cutting from solid blanks by machine. Both methods produce a very perfect wheel, and apparently are impossible of improvement.

Recently however an English inventor, Mr. A. E. Terry, a member of a well-known British engineering firm, has evolved an entirely new form of gear wheel, in the production of which also a new system of manufacture is employed. It is described as a laminated gear wheel. It is built up, but upon quite original lines. Instead of taking a solid blank of the required thickness, and machining the teeth, a number of thin disks of the desired metal are produced in an ordinary press, and the teeth on their peripheries are punched in accordance with requirements. These disks are then superimposed to the requisite thickness, and then clamped securely together by means of rivets, or bolts, producing a gear wheel as solid as that cut from a blank.

This is the elemental process and the disks can be fashioned from any suitable material, brass, mild steel, high tensile steel and so forth, at equal cost for labor. The rivet or bolt holes are punched simultaneously with the bore for the spindle, together with keyways or splineways, or they can be made to fit over a spider. The disks are then located on the tooth notching machine by the bore and the keyway, so that every other disk is identical as regards diameter of pitch circle, shape of tooth, and phase of the teeth relative to the keyway and bolt-holes. However, in building up the wheel each successive plate has its teeth phased one half tooth from its neighbor, the wheel thus comprising two distinct rows of teeth. This arrangement results in the halving of the virtual pitch and the doubling of the number of contacts.

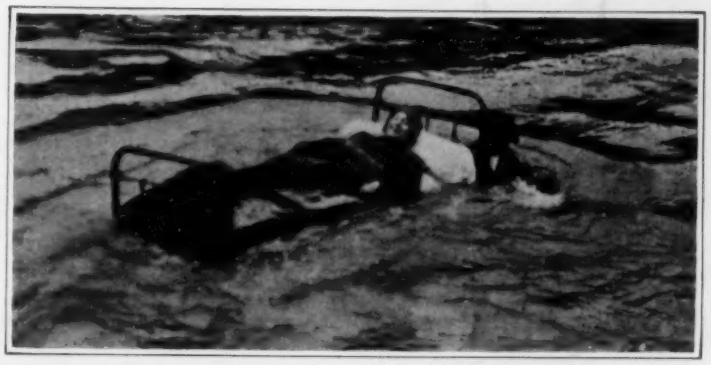
In the case of a large wheel the plates are mounted upon a spider, and bolted or riveted fast. The utilization of a spider allows a gear to be produced to any diameter, since the limiting factor is the spider and not the size of disks.

Should it be essential for the teeth of the laminated gears to be hardened there is no danger of distortion arising from the process, and subsequent grinding is not necessary. In hardening, the disks are packed on a mandrel to form a long pinion, with the teeth in line. Only the working faces of the teeth are hardened. The distortion of the disks is negligible, and when assembled, what little distortion may exist in regard to each individual plate, will not coincide with the rest, and hence it will be entirely neutralized.

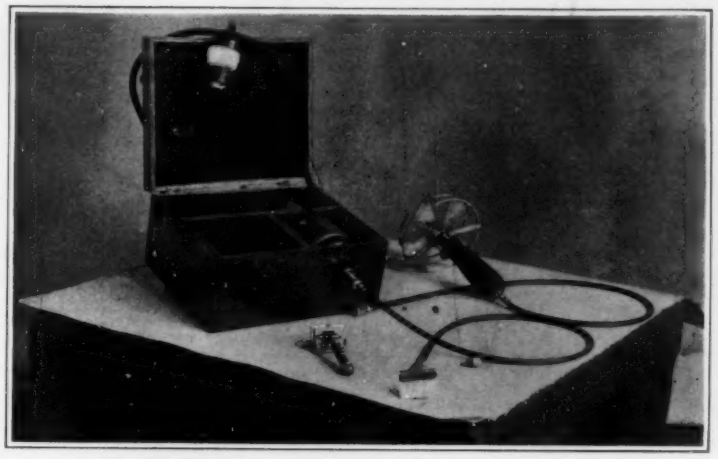
The machines employed in cutting the disks are of standard design, while the dies, comprising a punch and die, to produce one tooth at a time, need neither an expenditure of considerable skill nor time in their preparation, and are not so costly as the cutters required for milling gears out of the solid. However, as the plate is in no way stressed while the operation of forming the teeth is taking place, there is nothing to disturb the location in any respect. Consequently, each disk is cut accurately.

In building up the wheel the disks are spaced apart by means of metal washers so as to leave a clearance for the teeth to pass without friction. From the searching and varied practical tests which have been made it has been ascertained that the laminated gear presents many advantages over that machined from the solid. It is practically as silent in running as raw-hide or silent chain drives because there is no hammering as each tooth comes into mesh, and because there is no "ring" in the wheel itself, this secondary sound being quite eliminated by the adoption of the lamination principle.

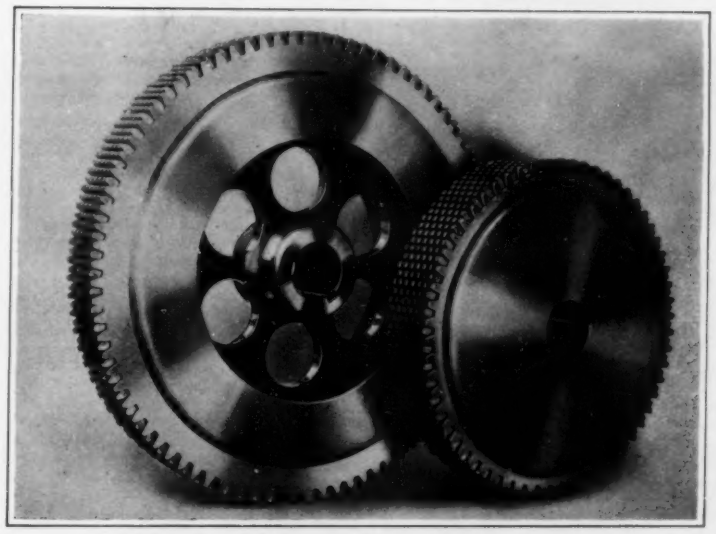
Another feature that cannot be overlooked is tooth fracture. In the laminated system this could only affect one or two plates, and would not throw the gear out of commission as is the case with a solid gear, while the defective disks may be readily replaced by dismantling the wheel.



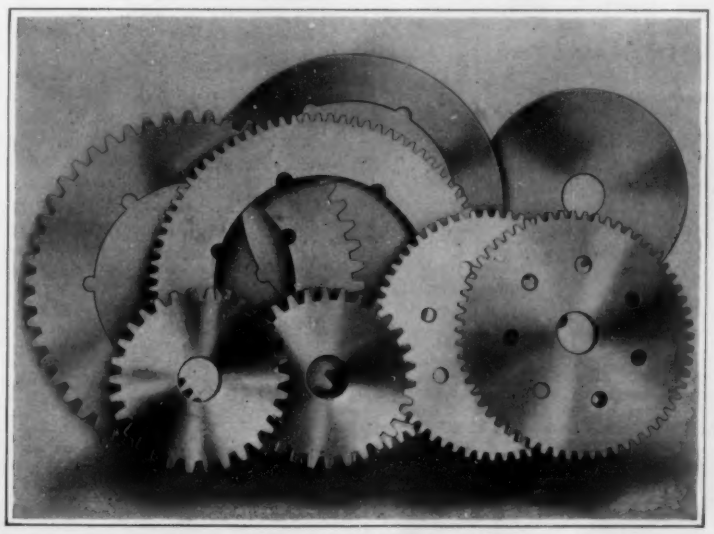
A bed as a life raft.



Vibrating razor that cuts the beard with a chopping action.



Gear wheels made up of disks clamped together.



Disks used in laminated gears.

Libraries in an Indian State

THE very progressive native state of Baroda, in India, has no less than 275 public libraries connected with its Central Library Department, which was organized by Mr. W. A. Borden of New Haven, Connecticut. These contain about 156,000 books, and within the last three years the number of readers is said to have increased nearly 360 per cent. The department has also a system of traveling libraries, which remain at each village three months, after which fresh books are furnished; besides which each village gets a grant for the purchase of books for local libraries up to $100 a year, provided an equal amount is subscribed by the inhabitants. The central library, in the city of Baroda, will shortly open a special department for women readers. A visual instruction department to educate people who cannot read, and to promote knowledge of the outside world by means of stereoscopes and cinematographs, is also in operation. The Central Library Department of Baroda issues the only periodical in India devoted exclusively to library topics. The literary development of Baroda is further indicated by the fact that in the year 1910 there were about 200 books published by natives in this state.

A New Route to the Belgian Kongo

AN event of great economic and geographical importance will be the opening, early in 1914, of the extension of the present railway across German East Africa to Lake Tanganyika. The eastern terminus is Dar-es-Salam, on the Indian Ocean. At the lake end the Germans are building the port of Kigoma-Ujiji, from which a line of steamers will run to Albertville, in the Belgian Kongo, where a port is now being constructed under the supervision of Capt. Mauritzen, hydrographer of the Danish Navy. Albertville is the terminus of the Great Lakes Railway, which in a few years will connect with the other railways of the Belgian Kongo and with steamers on the Kongo River.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

HOLDER.—J. MACDONALD, 218 W. 14th St., New York, N. Y. The invention refers to wardrobe fixtures, and provides a holder for neckties, buttons, scarf pins, coats, trousers, and other articles of wearing apparel and arranged for convenient attachment to a wall, wardrobe or the like, and for protecting the supported articles against dust.

Pertaining to Aviation.

AEROPLANE.—J. G. HANNA, 1215 S. Franklin St., Muncie, Ind. The purpose here is to provide a device for sustaining weight, and moving the same through air by atmospheric reaction on a curved surface or surfaces impelled either by a force of gravity or by mechanical power, and for insuring stability, great strength, and power of absolute control at all times.

Electrical Devices.

AUTOMATIC FUSE RESETTER.—J. B. ELKIN, 1802 Main St., Columbia, S. C. The main purpose here is to provide a device for use in connection with telegraph or telephone circuits for resetting fuses which have been burned out by lightning. A further object is to provide for automatically resetting any number of fuses, thereby obviating the necessity of setting the device after each operation, preparatory to the next.

Of Interest to Farmers.

ROTARY PLOW.—M. E. PLAYFORD, Wakelee, Mich. This improvement has reference to plows, the more particular purpose being the provision of a so-called "rotary plow" having spiral cutting blades so formed and fitted as to be specially adaptable for use in a motor plow. It can be readily assembled or taken apart for transportation or storage.

Of General Interest.

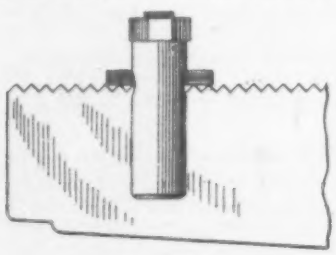
LIFE SAVING SUIT.—J. P. PARK, Beloit, Kan. Mr. Park's invention has reference to a suit more particularly designed to be worn by marine travelers in case of shipwreck. The suit is made from a suitable waterproof mate-

LIFE SAVING SUIT.

rial and may be provided with a life preserver, or be adapted to receive an ordinary life preserver. The body of the suit is provided with legs and arms as shown in the accompanying illustration, the arms, if desired, having integral mitts.

Hardware and Tools.

SAW JOINTER.—F. M. BARNARD, Milford, Iowa. This invention is an improvement in saw jointers which is always ready for use and which may be used on any type of saw. The device is small and compact, and with the



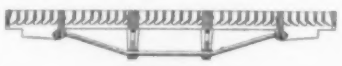
SAW JOINTER.

file removed, may be easily carried in the pocket. With the file in place, it is firmly clamped so that it cannot be displaced by its engagement with the teeth and when any part of the file becomes worn, the file may be shifted longitudinally or turned until it is completely worn out.

Heating and Lighting.

DAMPER CONTROLLING DEVICE.—F. A. KATELEY, 11 Wallace Ave., Mount Vernon, N. Y. The invention provides a device arranged to actuate the damper according to the pressure of the steam generated in the steam-heating apparatus, to prevent spilling of water in case of excess pressure in the apparatus, or in case a siphoning action takes place on forming a vacuum in the steam compartment of the steam-heating apparatus.

GRATE BAR.—G. S. SERGEANT, Greensboro, N. C. This invention is an improvement particularly in grate bars made in sections held together end to end, and relates to means for supporting the sectional grate bar at the middle portion thereof. Means provide for em-



GRATE BAR.

ploying the longest grate bars ever required without increasing the weight per linear inch, thus making the cost per linear inch no greater for long bars than for shorter lengths. Any style of grate surface and of vent can be employed to suit the various kinds of fuel which it may be desired to use.

Household Utilities.

ICE CREAM FREEZER.—E. THOMPSON 202 E. 46th St., New York, N. Y. In this device a circulating brine or similar freezing fluid is used as the freezing medium. The invention provides a freezer arranged to provide a large refrigerating surface, to avoid dormant non-freezing surfaces, thus insuring a more rapid freezing and preventing deterioration in the texture and quality of the ice cream.

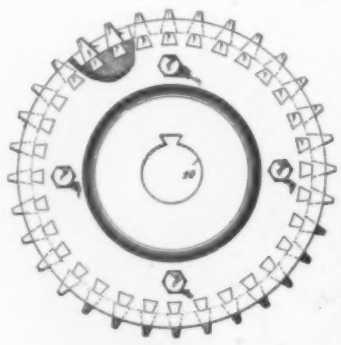
Machines and Mechanical Devices.

CLUTCH.—J. J. GILMARTIN, Guild, Tenn. Mr. Gilmartin's invention is an improvement in clutches, and has for its purpose to provide a clutch, especially adapted for splicing flexible

CLUTCH FOR CABLES, ROPES, ETC.

members of metal, as for instance cables, ropes, and the like, wherein mechanism is provided for rigidly holding the ends of the cable together in the form of a square or reefing knot. With the use of the improved block there is no weakening of the cable at the knot.

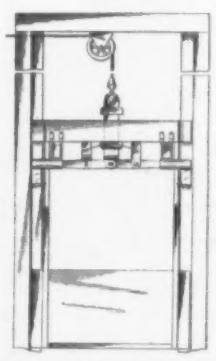
GEAR WHEEL.—A. S. FINCH, 70 Henry St., Passaic, N. J. This invention provides a gear wheel having gear teeth dove-tailed removably in the periphery of the body of the wheel with base extensions which are adapted to engage in openings in plates applied to the sides of



GEAR WHEEL.

the body of the wheel, whereby the said plates hold the gear teeth against lateral displacement and also afford additional securing and strengthening means for the teeth.

SAFETY DEVICE FOR ELEVATORS.—M. C. HUTCHINGS, Bozeman, Mont. This invention provides a device for use with elevators, mine hoists and the like, which becomes operative instantly if the cable of the elevator becomes broken or relaxed, and which then



SAFETY DEVICE FOR ELEVATORS.

serves to bring the elevator car to a stop before it can travel any material distance, which will in no manner interfere with the normal operation of the elevator, that cannot be inadvertently rendered operative when not needed, and which can be instantly automatically released after the grips have become operative.

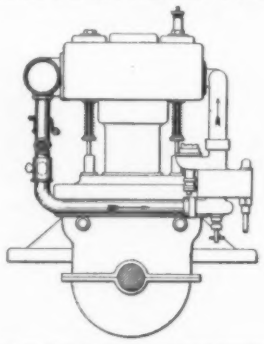
COAL CONVEYER.—O. E. BARENE, 403 Albemarle Road, Brooklyn, N. Y. This conveyer for handling coal or other articles of merchandise in bulk includes an endless series of buckets and adapted for free operation in any position of adjustment with respect to movement laterally around a vertical axis or with respect to vertical adjustment parallel to said axis.

ENVELOP OPENER.—W. N. BURNITE, Roanoke Ave., Riverhead, N. Y. In this patent the invention has reference to stationary articles and particularly to devices for opening envelops or the like by means of a cutter adapted to cut a slit closely parallel to one of the lateral edges or ends of the envelop.

STOP MOTION.—F. AINSWORTH, 877a Gates Ave., Brooklyn, N. Y. This stop motion is more especially designed for use on sewing machines and the like, and arranged to automatically stop the machine whenever the needle thread or the shuttle thread breaks or runs out, and to permit of conveniently applying the stop motion to sewing machines as now constructed.

Prime Movers and Their Accessories.

STARTER FOR INTERNAL COMBUSTION ENGINES.—S. G. BERRY, Tyndall, S. D. The invention refers to a starting construction for internal combustion engines, and the purpose is to provide a starter comprising a pipe con-



STARTER FOR INTERNAL COMBUSTION ENGINES.

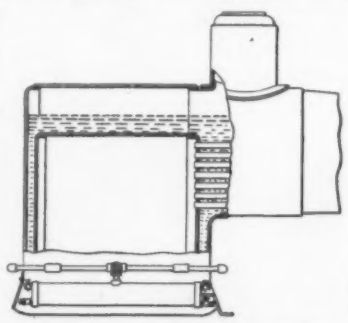
nected to supply air warmed by the exhaust of the engine to the carbureter, and having means therein for vaporizing a sufficient quantity of gasoline independently of the carburetor in order to facilitate the starting of the engine in very cold weather.

GASKET AND RETAINER THEREFOR.—A. E. HART, 4 Fourth St., New Brighton, S. I., N. Y., N. Y. The intention here is to provide a structure designed to hold a gasket in place in an automatic air coupler under high pressure, the same co-acting with a high pressure air pipe and with resilient means for holding the coupler in a predetermined position for maintaining the gaskets of co-acting coupler heads in contact.

INTERNAL COMBUSTION ENGINE.—J. KERNER, Avenue d'Argenteul 266 Asmeres, Paris, France. This invention relates more particularly to an engine of the two-cycle type which comprises a cylinder, a crank case closed with respect to the cylinder and a piston in the cylinder and having a piston rod intermittently effecting communication between the cylinder and the crank case.

Railways and Their Accessories.

AUTOMATIC MUD DRUM FOR BOILERS.—A. F. SHREVE, Hoisington, Kan. This invention relates to mud drums for boilers, the particular purpose being to provide a mud drum so constructed and arranged as to be automatic in the sense that it operates continu-



AUTOMATIC MUD DRUM FOR BOILERS.

ously and positively in the removal of mud and sediment from the boiler. The invention further relates to provision of means for removing the mud and sediment from the mud drum.

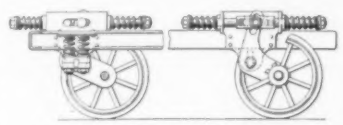
STORMPROOF CAR DOOR.—G. M. KIRBY, Aurora, Mo. The main object in this instance is to provide a door for a railway car or other inclosure that will be simple and practical in its construction, and so mounted as to make a perfectly stormproof covering for the doorway with which the same is to be used.

Pertaining to Recreation.

BATHING BOAT.—C. M. JOHNSON, care of A. Johns, 60 Wall St., New York, N. Y. This inventor provides a boat having a supporting section submergible at will, to form an inclosed bathing area arranged to prevent accident to the bather; provides a pleasure boat having a deck through which water freely passes, and means for, at will, submerging a portion of the deck for bathing; provides a boat with a motor-actuated propelling means; and provides means for steering or guiding.

Pertaining to Vehicles.

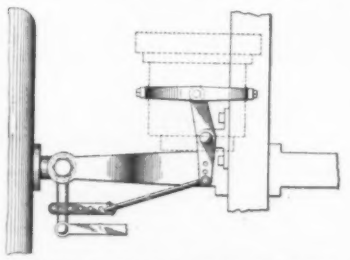
VEHICLE SPRING SUSPENSION.—L. E. BUSHBY, 180 Badger Ave., Newark, N. J. This invention relates to an improved spring suspension which absorbs all shocks lengthwise and sidewise to the frame, and does away with the necessity of using pneumatic tires on motor cars. A mechanism is devised in which the vertical movement of the axle is yieldingly resisted on the frame, both when the frame and axle move toward each other and when away from each other, and the invention also provides a means for making the attachment between the frame and the axle more flexible by



VEHICLE SPRING SUSPENSION.

giving each individual wheel, or rather its ends of the axis, a limited movement without affecting the other end of the axle or the other wheel on the same end of the frame. Shock absorbing devices of this kind have been employed, but the present invention relates to the flexible attachment of each end of the axle to the body of the vehicle or the frame. In prior devices the shock absorbers in instances have been connected by transverse connections. In this invention each end of each axle is supported in a way that permits that end of the axle and the frame to have a relative movement without affecting the other end of the axle or the other axle.

DIRIGIBLE HEADLIGHT.—A. C. HENDRY, care of Walter Scott, Davenport, N. Y. This invention relates to apparatus for connecting a headlight or headlights to a moving vehicle, having particular reference, however, to auto-



DIRIGIBLE HEADLIGHT FOR AUTOMOBILES.

mobile headlights whereby at least one of the lights will be caused automatically to be steered in unison with the steering apparatus of the vehicle so as to illuminate the roadway in the direction in which the vehicle is to be operated at the turn.

AUTOMOBILE TOP.—CARL V. BEEBE, Mount Gilead, Ohio. This invention relates to automobile tops comprising a canopy or curtain, and means for securing the curtain in position or for storing it when not required for use. The top can be placed in position with convenience and dispatch, and quickly and conveniently lowered and stored into small compass when not in use. The auto-top can be raised by an occupant without leaving the car and one can raise and lower it without assistance. The invention may also be employed in connection with other vehicles.

VEHICLE MOUNTING.—A. A. PRATT, 54 Wall St., New York, N. Y. The invention provides a mounting or suspension which is exceedingly sensitive and arranged to take up all jars and jolts incident to the vehicles traveling over rough roads, obstructions and the like, to insure easy and comfortable riding without requiring the use of pneumatic or similar tires, thus reducing tire expense to a minimum and eliminating danger and delay caused by bursting tires and the like.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Notes for Inventors

A New Product in the Form of Butter.—Joseph Moses Ward Kitchen, of East Orange, N. J., has secured a patent, No. 1,072,238, for manufactured and packed butter. This is defined as a butter that has been in a state of frigidity from the time it has been made to the time it reaches the consumer. By keeping the temperature below the freezing point proliferation of the germs in the butter is prevented. Still, the germs in the butter are in a state of vital inhibition and the butter is substantially free from objectionable flavors and odors due to the vital activity of germs.

Protecting the Baby's Head.—Belle G. Fitch, of Philadelphia, Pa., has patented a head protector for babies which has a single pneumatic tube of soft expansible material which fits around the head horizontally and has pairs of converging tubes which extend upwardly from the opposite sides of the horizontal tubes, with all of the tubes in communication with each other. The patent is numbered 1,072,321.

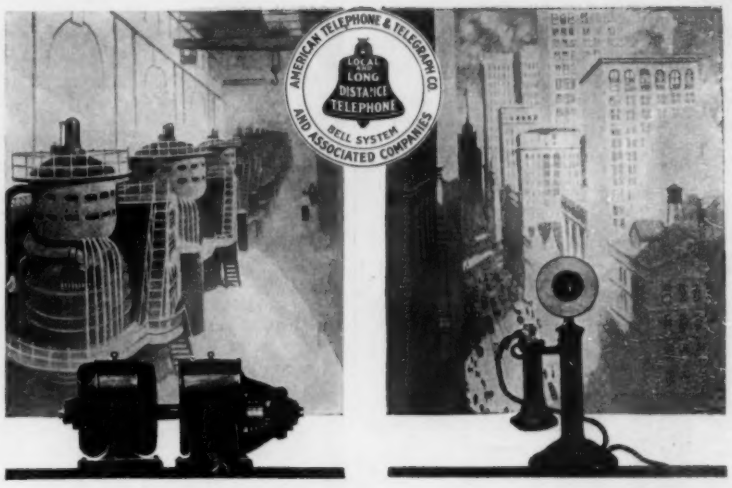
Toy Suggestions.—Two forms of toys appear to be more or less neglected at the present time. These are the airship toys which are projected and sail through the air, and the toy doll and animal figures carried on the hand and manipulated by the movements of the fingers. The airship toys present a field for improvement in the projecting devices and in the stabilizers and direction controlling features while in flight. Possibly the toys could be made to return boomerang fashion. The doll and animal figure toys present opportunities in the way of novelties in the design of the toy as well as in devices for facilitating manipulation to more nearly simulate the lifelike movements.

A Geographical Amusement Device.—In patent No. 1,070,546 to Hanson Robinson of Detroit, Mich., as assignee of John F. Sherlock and Henry Spengler of New York city, is presented a toy having a hollow globe with geographical markings and inclosing a magnet loosely mounted in the globe and counter-weights to preserve an upright position, and operates a keeper in the form of a ship on the outside of the globe so the ship by the turning of the globe can be made to appear to travel along any desired route.

A Gastronomic Clock.—A curious "gastronomic clock" is said to have been made in the old times by an ingenious Frenchman for telling the time in the dark. He installed a large flat clock dial beside the bed on which the hours each had a small cavity. In each one he placed a different spice, for instance, the figure 12 held quiqe and the figure 6 cloves, and so on. To find the time, he followed the short hand with the finger and then tasted the contents of the cavity opposite, then he did the same for the long hand, and had he pasted pepper and nutmeg, for instance, he knew that the hour was half-past three.

An Invention of the Future.—Thomas A. Edison is reported as saying that an improvement to be expected in the future is along the line of permitting the re-use of paper for newspaper purposes, by removing the printer's ink so the paper can be used a second time. Economy would be doubly served by such an invention as it would not only permit the re-use of the paper but might also lead to a recovery at least in part of the ink or ink particles for subsequent use if the ink should be removed from the paper.

Base Signal for Baseball Fields.—With the kindest of motives and in behalf of the poor umpire of a baseball game, Stephen H. Wills has invented a base for a baseball field which will give an alarm or signal when a runner reaches or touches it, thus avoiding the dispute which now commonly takes place between the runner and the umpire and the other members of the team as to whether or not the runner reached first base before the baseman caught the ball. This is accomplished by having the baseplate or bag hinged and raised at one edge by a spring. When the runner touches the base it is depressed, making an electrical contact which sounds the alarm or raises the signal. The number of the patent is 1,066,773.



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ENGINEERING AS A PROFESSION. Scope, Training and Opportunities for Advancement. By A. P. M. Fleming, M.I.E.E., and R. W. Bailey, Wh. Sc., Principal of the Technical Institute, Crewe. London: John Long, Limited, 1913. 8vo.; 288 pp. Price, 2s. 6d. net.

Knowing the proud position attained by the profession of engineering under the complex physical conditions of modern civilization, and having heard of the rich rewards many of its members have won, parents are too apt to overlook the prime necessaries of individual leaning and talent, and the arduous, skillfully-directed years of labor and learning that are indispensable to even a moderate success. The authors of this friendly guide are well qualified to disperse the prevailing ignorance that, failing to recognize what constitutes a suitable course of training, or to grasp the conditions surrounding engineering employment, practically invites ignominious failure in the chosen profession. The work in hand broadly reviews the various branches of this profession, tells exactly how the necessary training may be acquired and at what cost, with a special chapter devoted to the acquirement of such knowledge at a minimum expenditure, and discusses appointments in civil, mechanical, and electrical fields, with particular reference, of course, to Great Britain and her colonies. Under "Foreign Methods" is sketched the training of engineers by the German and American systems.

WIRELESS TELEGRAPHY. By C. L. Fortesque, M.A. New York: G. P. Putnam's Sons, 1913. 16mo.; 143 pp.; illustrated. Price, 40 cents net.

This text is addressed to the reader having some general scientific knowledge, and deals with an important subject in a manner that is simple yet adequate to the purpose. The electrical phenomena involved are explained as far as possible by mechanical analogy. The principles of these phenomena are then applied to wireless apparatus, and the latter half of the little volume is given over to a survey of the most modern uses of the art. Marconi and Telefunken apparatus are clearly shown in illustrations, and the arrangement and operation of the instruments is thoroughly explained.

ADDRESSES AND PAPERS ON LIFE INSURANCE AND OTHER SUBJECTS. By John F. Dryden. Newark, N. J.: The Prudential Insurance Company of America, 1909. 8vo.; 330 pp.

These papers deal with the inception, progress, and results of industrial and ordinary life insurance, and will prove of the highest value to those interested in the subject. The author was United States Senator from New Jersey from 1902 to 1907, and his senatorial utterances on the American type of Isthmian canal are included in the volume.

PEARLS AND PEARLING. By Herbert H. Vertrees. New York: Fur News Publishing Company, 1913. 12mo.; 203 pp.; illustrated

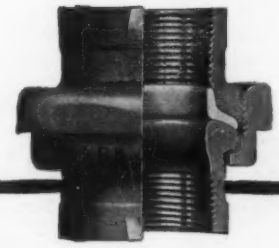
Few people realize that the United States has a well-established pearl industry—that, for example, in 1910 there were 2,600 pearling boats on the Illinois River, and that this is but one of many rivers that yield the pearl mussel. Mr. Vertrees' little book is a clear exposition of the methods and paraphernalia of sweet-water pearl hunting, and fills a gap in the literature of the subject. It also enters into the history and origin of the pearl, describes the life and habits of the mussel, and adds a description of the "cripple" in which the fine pearl is oftenest found. The values and uses of the various shells are listed, the reader is instructed in the art of prospecting, and the crow-foot dredging outfit and its manipulation is thoroughly described. There is, too, a study of the influence of local conditions upon the color of shells and pearls, and the luster of the pearl is explained. The manual is quite up to date in information and in methods, and not only affords the prospective pearl hunter invaluable information, but also interests the general reader in no small degree.

SEEHAFENBAU. Von F. W. Otto Schulze, Professor des Wasserbaues an der Technischen Hochschule in Danzig. Band II. Ausbau der Seehäfen, Berlin: Wilhelm Ernst & Sohn, 1913. 8vo.; 523 pp.; mit 574 textabbildungen bestehend aus 957 Bildstocken. Preis des Werkes, Geh. 24.—M. Geb. 25.—M.

We mentioned favorably the first volume of Prof. Schulze's work on its appearance some time ago. Vol. II is an extension of the thorough studies of the first volume, carefully expounding harbor construction as exemplified in the harbors of the world. The various features of construction are progressively considered—breakwaters, moles, bulkheads, seawalls, wharves, piers, towers and structures pertaining to the loading and unloading of vessels, and the various types of crane, including the floating crane. There is a section also on excavators and dredges. By means of unstinted sketches every detail of plan and structure is distinctly shown. There is an exhaustive index covering both volumes.

THE PHYSIOGRAPHY OF THE RIO GRANDE VALLEY, NEW MEXICO, IN RELATION TO PUEBLO CULTURE. By Edgar Lee Hewett, Junius Henderson, and Wilfred William Robbins. Washington: Government Printing Office, 1913. 8vo.; 77 pp.; with maps and illustrations.

This bulletin is the result of two years' cooperative work by the School of American Archæology and the Bureau of American Ethnology, and consists of three papers on the Rio Grande Valley, its geology and topography, its climate and the evidence of climatic changes.



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The Industrial Need of Technically Trained Men—IX

The Possibilities in Iron and Steel Making

By S. T. Wellman

[Mr. S. T. Wellman, the author of the following article, has had a large part in the development of the iron and steel industry from small proportions just after the civil war to the enormous production of to-day. He is the inventor of a tilting open hearth furnace and of the charging machine which made the open hearth furnace practicable. Mr. Wellman has been general superintendent and engineer of the Otis Iron and Steel Company and president of the Wellman Seaver Morgan Company. He is past president of the American Society of Mechanical Engineers and of the Cleveland Engineering Society. He is a member of the American Institute of Mining Engineers, the American Iron and Steel Institute and of the British Iron and Steel Institute.—EDITOR.]

IS the profession of "Iron and Steel Making" a good one to follow? This is a question that is asked many times by young men who are trying to make up their minds as to their life's work.

The answer will depend very largely upon the man. Many would not like the business at all, and some, as I have seen them do, would turn and leave at the first sight of what the work and conditions are, saying: "None of that for me."

One young man that I remember many years ago, at his first sight of a Bessemer converter timing up, sending as it always does a shower of fire across the building, turned and fled headlong and never stepped inside the works again.

To me the iron business is the most fascinating in the world. All of the processes are interesting. New problems, mechanical and metallurgical, are constantly coming up to be solved.

There is plenty of room in the iron business for workers, but none for drones. The young man who adopts it for his life's work must have in the first place a good physique; he must be strong and healthy in mind and body, not afraid of work or dirty hands or rough clothes. He must expect at times to make long hours, when he is learning the business, and at times he will have a great deal of night work.

A college or technical school education is not absolutely necessary, but it is very desirable. The young man who starts in the business without such an education, must make up for the lack of it by a lot of self education at home, if he wishes ever to reach the top of the ladder. That it is possible to do this is shown by the careers of many of the brightest and most successful men in the business. Night and correspondence schools are open to the poor working boy who has the ambition to rise, and who is bound to learn all that is worth learning in his chosen profession. The very fact that he has to work hard in the face of all kinds of difficulties to learn what he is after, is the best kind of a beginning of a training for what is to come.

Many times, when asking professors at technical schools and colleges to send me graduates for different positions, I said to them: "Everything else being equal, I would rather have a poor boy who has worked his way through college than a rich man's son who doesn't know the value of a dollar, and whose chief reason for being at college is to have a good time."

The common opinion is that the poor boy is the one who is handicapped in making the race for real success in life. I am not sure but that this is wrong, and that it is very possible that the rich man's son, surrounded by every luxury, who lives in a beautiful home, with a doting mother watching over him, who never learns or knows the value of money, is the one to be pitied, and is really the boy who is handicapped.

The best assistant that I ever had was a young man who was the son of a barber. He graduated at the high school, after which he went to work in the office of an iron works of his native town. In a year or two he had saved five hundred dollars. With this and the addition of one thousand dollars which his employer loaned him, he went to Germany, where he stayed four years. This amount of money paid all his expenses. Of course, this was possible only by the exercise of the most rigid economy. He entered the University of Berlin, where he graduated, taking the highest honors that any American had taken up to that time. He spent all of his vacations in various iron works as a learner, thus not only getting at the details of the business practically, but making many acquaintances that were valuable to him in after life. It is needless to say that he succeeded in everything that he took hold of. A man who goes at things in the enthusiastic way of this young man, is always sure to succeed.

A most excellent way for any young man to do who is trying to make up his mind whether he wants to learn and follow the iron business, is to spend one of his vacations, or a portion of it at least, in some steel works or rolling mill.

After this experience, if he makes up his mind that he wants to learn the business and follow it up as a profession, he can go back to school and go to work in earnest to learn any and everything that will help him in his chosen field of work.

I believe it is a most excellent plan for a student to spend at least a month of each year out of his vacation in some works, seeing the thoroughly practical side of the business. Every time after doing this, he will go back to college with fresh courage and a better understanding of what he needs to learn, and he will see how necessary the purely theoretical part of his education is.

Of course, no matter what profession a young man follows, one of the great advantages of a course at college is the associations and the acquaintances he makes there, which will always be pleasant and useful to him in after life.

When he has finished at college and obtained his coveted degree, he must not think that he is fitted to take charge of any works, or even a department of it. If he has sense, he will know that he is only learning the theory of things, but the hard practical part he has yet to learn.

A man who expects to be a leader in any business should know every detail. He should be able to take any workman's place for a short time. I don't mean to say that he should work at every branch of the trade long enough to become a first-class workman, but he should work at it long enough to get a thorough, practical understanding of it. If he does not do this and does come to a position of responsibility, not understanding the details in a practical way, the workmen will very soon find it out and they will be sure to take advantage of his ignorance.

Of course, if a young man goes into the iron business and expects to earn a living with his hands and muscles only, and to be merely a workman, skilled or unskilled, book knowledge will not help him very much. He might as well stop with a common school education. But if he wants to make his brains and not his hands do the work, he must get all the help possible from the best that books can teach. Of course the scientific school is the best place to do this.

Workmen who have a superintendent under whom they have learned their trade are more easily managed than if they had brought their trade with them, and its details are in any part a secret from the management. If they know that the superintendent knows just as much about it as they do themselves, they will know that, having taught them, he can teach others. Strikes are not likely to happen where the management is in such hands.

To my mind, the business of the ironmaster is the most interesting of any of the great professions. Every part of the work is full of the most interesting and picturesque detail, from the taking of the crude material from its bed in Mother Earth to the turning out of the finished iron and steel, and nowhere is it carried on in such magnificent scale as in this country in which we live.

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(12910) P. R. B. asks: Please inform me if I can get through you any literature descriptive of the experiments by which the velocity of sound in water was determined. A. The velocity of sound through water was measured in 1826, by Colladon and Sturm in the water of Lake Geneva. A bell under water was struck, and at the same instant some gunpowder was flashed in the air above. At a station more than 13 kilometers (8 miles) away a sort of big ear-trumpet, closed by a membrane, was placed with the membrane under water, the tube rising above the surface. An observer with his ear at the tube noted the interval between the arrival of the flash and the sound. The velocity deduced at 8.1 deg. Cent. was 1435 meters per second, agreeing very closely with the calculated value. This account is taken from the Encyclopedia Britannica, eleventh edition, vol. 25, page 443C.

(12911) C. C. asks: Can you give me a simple and comparatively inexpensive formula that will remove fat or grease from enamel and porcelain "plates"? A. The best solvent for fat or grease is potash. This changes the fat into soap and it is then easily removed with water. Any acid which would cut the grease would be so strong that it would also cut the skin of the person working with it.

(12912) F. P. asks: How is it possible for a wind instrument to be "flatted" or blown out of tune? A. The changing of the tone in pitch by overblowing, as it is called, is common to all wind instruments. It is treated in Barton's "Sound," under the several instruments. We send the book for $3.25 postpaid. With instruments where the lips form the reed whose vibrations produce the tone, the size of the tube and the temperature of the air have an important effect upon the pitch of the tone. On the cornet it is said that the player can force the note a quarter tone flatter or sharper than its normal pitch. Barton, page 449.

(12913) J. M. L. asks: Can you furnish me with a description or give any information pertaining to apparatus for producing nitric acid from atmospheric air, from Bradley and Lovejoy, Birkeland-Eyde? It is mentioned in the SCIENTIFIC AMERICAN of September 6th. A. We have published several papers on the modes of producing nitric acid by the electric arc. You will find them in our SUPPLEMENT Nos. 1640, 1641, 1642, 1643, 1644, a series; also 1667, 1668, 1691, 1692, 1748, 1767, and 1784, price ten cents each. These papers will give you a complete review of the subject.

(12914) H. W. R. asks: I would be glad to know your authority for the statement that the Roentgen rays have the precise wave length of 0.01 micron. A. The authority for the statement of a wave length for Roentgen rays is the reports upon the diffraction and interference measurements of these rays, which have appeared in the scientific periodicals for several years past. If you are a member of the American Physical Society, you will have a file of the Science Abstracts. Section A, in which you will find the abstracts of these papers. We would refer you to the following: June 30th, 1913, vol. 16, part 6, Abstract 994; July 28th, 1913, vol. 16, part 7, Abstract 1,153; October 27th, 1913, vol. 16, part 10, Abstract 1,667. We might name others. These are all references to German scientific publications. We give the reference to the Science Abstracts since you are more likely to have that at hand than the original German publication. The results of these investigations are not in complete accord in the wave lengths and could not be expected to be, as you know.

(12915) M. Z. Asks: Kindly let me know through your correspondance column the correct conclusion to the following experiment. The experiment consists of balancing a 50-centimeter stick which is weighed down on one end. The point where it balances is found to be 39.6 centimeters from one side. Then put a 50-gramme weight on the end of the lighter side. The stick now balances at 32.4 centimeters. The 50-gramme weight took up the space of 2 centimeters on the stick. Now A claims that the weight of the weighted stick originally can be found from this to be 218.1 grammes, which he gets by multiplying 50 grams × 31.4 (distance between centre of weight to point of equilibrium) and dividing by (39.6—32.4) or the distance from the first point of equilibrium to the second point of equilibrium. Also that these 218.1 grammes act as if they were concentrated at the point 39.6. B contends that the first moment is not 50 ×31.4, but that the weight of 32.4 centimeters of stick must with the 50 grammes be considered as the weight tending to produce the moment of rotation. This multiplied by the distance that the resultant of these forces is from the point 32.4 is the moment. Also he contends that A makes the same mistake in the other arm; and the weight to be considered here is not the weight of the whole stick, but of that arm, and is not concentrated at the point 39.6. A. A is quite correct in his solution of the problem of moments, with a weight upon the end of a 50 centimeters bar, which balances at 39.6 centimeters from the light end, and when a 50-gramme weight is added to the light end balances at 32.4 centimeters from the 50-gramme weight. The answer is 218.055 +centimeters, or 218.1 centimeters as A gives it. It is a universal principle that any body acts as if its matter were all at its center of gravity. This weight is 7.2 centimeters from the last balancing point, and the center of gravity of 50 grammes is at 31.4 centimeters from the balancing point. Then 50 times 31.4 equals 7.2 times the weight of the stick and small weight. This is one of the usual experiments in moments given to students in the high school course in physics, and is not considered a difficult experiment for the beginner.

(12916) M. J. G. asks: Kindly inform me the fusing points of the following metals: plumbago, iron, wolfram, tungsten, nickel. What I wish to know are the fusing points by electric currents. A. We give you the melting points of the substances which you name, as given in the Circular of the Bureau of Standards, No. 35. Iron melts at 1,520 deg. Cent. or 2,768 deg. Fahr. Tungsten or wolfram melts at 3,000 deg. Cent. or 5,430 deg. Fahr. Tungsten and wolfram are the same. Nickel melts at 1,452 deg. Cent. or 2,646 deg. Fahr. It makes no difference what source of heat is employed, electricity or a flame, the substance melts at the same temperature. Plumbago or carbon is not a metal, but its melting point is given as 3,600 deg. Cent. or 6,500 deg. Fahr. for a pressure of one atmosphere. This temperature is given by the electric arc, and possibly by some gas flames. The figures we have given vary somewhat from those given in the textbooks, but they may be assumed to be later and from better determinations. We should consider them as having a higher authority.

(12917) A. C. H. F. asks: Could you furnish me with any information concerning the Tralle and Richter scale as applied to hydrometers. I have sought information in several books, but could find no reference as to the method of graduation of these scales, and I would be greatly obliged if you could send me some information on this subject. A. Tralle's hydrometer is an alcoholometer, and gives the percentage by volume of alcohol in a solution of alcohol and water. It is based upon water at 40 deg. Cent. and a density of pure alcohol 0.7939 at 15.5 deg. Cent. The corrections for other temperatures must be obtained from a table. You will find a good article upon hydrometers in the Encyclopedia Britannica, vol. 14. The scale begins from the density of pure water, and indicates 1, 2, 3 per cent, etc., of alcohol by volume mixed with the water.

(12918) R. H. T. asks: How is the wire wound in such even layers on the magnets used in telephone ringers and on the secondaries of induction coils? A. Wire is wound on the bobbins for the coils of magnets, etc., in the same manner as thread is wound on spools. A machine turns the bobbin and a carrier moves the wire along for each turn of the bobbin as far as the thickness of the wire. At the end of the bobbin the machine feed is reversed and the winding is carried along in the opposite direction. So the wire is wound on in perfectly even layers in a manner impossible to be done by hand. It is done with great rapidity.

(12919) S. de J. asks: Will you be kind enough to let me know what the chemical name is of so-called banana oil, used as a vehicle for gilding? A. The chemical name for banana oil is amyl acetate. It is used in perfumery, the manufacture of mineral waters, and syrups, and in the Heftner lamp as a standard of light, as well as in stains and gilding.

(12920) N. S. asks: Have you any information for making a syrup by adding 6 pounds sugar to ½ gallon of water, and either boiling or dissolving the sugar and placing same in a sealed can, using a process in which it will not ferment or turn back to sugar when in such sealed can, and not use any preservative? A. The only way we know to preserve a solution containing sugar is to sterilize it by heat and seal it air tight in a can. The method is the same as is used in canning fruit. If air comes in contact with the solution, germs of fermentation will surely get in and the syrup will be spoiled.

(12921) I. W. asks: Some time since I received one of your books of formulæ, and I find that the very one I want is a bit ambiguous. I wish you would set me straight. The formula I want to use is the one for nickeling, page 481. Am I to understand that there are three separate baths; First, potash and chlorhydric acid; second, sulphate of copper, sulphuric acid; third, cream of tartar, etc.? The formula also fails to state what sized leaves of zinc to use or how to attach them. Must the zinc be chemically pure or will ordinary commercial zinc do? A. There are three baths in the process of nickeling as given in the "Scientific American Cyclopedia," page 480. The first bath is the cleaning bath, to cut off all the grease and rust and leave the articles so that the metal will adhere as firmly as possible. After they are cleaned they are attached to strips of zinc. Common sheet zinc is employed, nor is a large piece required. A piece 2 inches by 4 inches will answer for a large sized article. Experience will enable you to decide that. In the second bath, as given in the book, an electrical action takes place and the article is plated with copper. The nickel will not adhere well to iron, but copper will adhere well to iron. When the pieces are well coppered, they are red in color, and the third bath of nickel sulphate is used for the final coating with nickel. The after burnishing and polishing is the same as in all work of that kind. We hope this is clear and plain.

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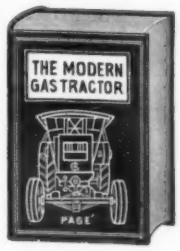

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Author of "The Modern Gasoline Automobile," "The Modern Gas Tractor," Etc., Etc.

5¼x7½ Inches. 622 Pages. 329 Illustrations. 3 Folding Plates. Cloth.

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TO THE POLICY-HOLDERS:

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New Business (109,763 Policies)		$232,800,000.00
Gain over 1912		34,000,000.00
Risks in force January 1, 1914 (1,101,655 Policies)		2,273,000,000.00
Gain over January 1, 1913		103,000,000.00
Dividends allotted (1914)		17,600,000.00
Increase over 1913		2,200,000.00
Income		124,000,000.00
Disposition of Income:		
Death claims	$26,000,000	
Matured Endowments, Surrender Value, etc	25,000,000	
Dividends	15,000,000	
Expenses, etc., including Taxes ($1,352,956)	15,000,000	
Added to Reserves	43,000,000	$124,000,000.00

The Investments of the Year (Outside of Loans on Policies) were $41,740,459.14

As follows:

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Domestic and Canadian, State and Municipal Bonds $8,421,095.17

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Foreign State and Municipal Bonds 7,149,471.41

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Railroad Bonds 9,856,651.23

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Loans on Business Property 15,189,078.66

INVESTED TO PAY 5.58%

Loans on Farms (New Department) 920,885.17

INVESTED TO PAY 5.50%

Miscellaneous Bonds 203,277.50

INVESTED TO PAY 4.88%

Analysis and Earning Power of Ledger Assets on December 31, 1913:

Railroad Bonds (4.27%)	$311,949,214.47
Foreign Government and Municipal Bonds (4.19%)	83,022,625.44
Policy Loans (5%+)	133,507,619.52
Premium Notes (5%+)	4,598,039.71
Mortgage Loans, including Farm Mortgages (4.97%)	152,970,898.44
State and Municipal Bonds (4.04%)	53,177,784.79
Miscellaneous Bonds (6.67%)	7,003,132.23
Stock (Received from Reorganizations)	284,046.88
Real Estate Owned (4.36%)	9,196,586.10
Cash (2.50%)	7,140,755.82
TOTAL	$762,850,703.40

AVERAGE EARNING POWER OF ALL ASSETS AS OF DECEMBER 31, 1913: 4.54%

INCREASE IN EARNING POWER SINCE DECEMBER 31, 1905: 0.32%

TRANSLATED into income, this increase, if maintained, will yield an added income in 1914, and annually thereafter, of $2,441,000.00

LIABILITIES:

Reserve to cover contract obligations	$642,598,782.00
Other reserves (taking securities at Market Values)	105,898,958.00
	$748,497,740.00

The low price of bonds and the high rate obtainable on real estate mortgages made the year a good one for investment.

The wording of the Federal Income Tax was materially improved and policy-holders generally benefitted by the intelligent response made to our letter to policy-holders, sent out last April. The united protest of policy-holders against unfair legislation is something that all legislatures, Federal and State, will have to reckon with in the future.

A statement consisting of 168 folio pages, giving in minute detail the transactions of the year, schedules of the Company's assets, and a vast deal of additional information, will be filed with the Department of Commerce in Washington, with the Government of each State (except one) of the United States, and with the Governments of all the leading Countries of the world. A brief of this, containing important details, will be sent to policy-holders during 1914, and will be mailed to any one on request.

January 8, 1914

DARWIN P. KINGSLEY, President

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